Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region

1999 Annual Report

May 2001

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Western Pacific Regional
Fishery Management Council
1164 Bishop Street, Suite 1400
Honolulu, Hawaii 96813

Cover photo: Northwestern Hawaiian Islands limited entry Ho'omalu zone permitted bottomfishing vessel "Laysan"

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National Marine Fisheries Service
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Honolulu, Hawaii

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for the

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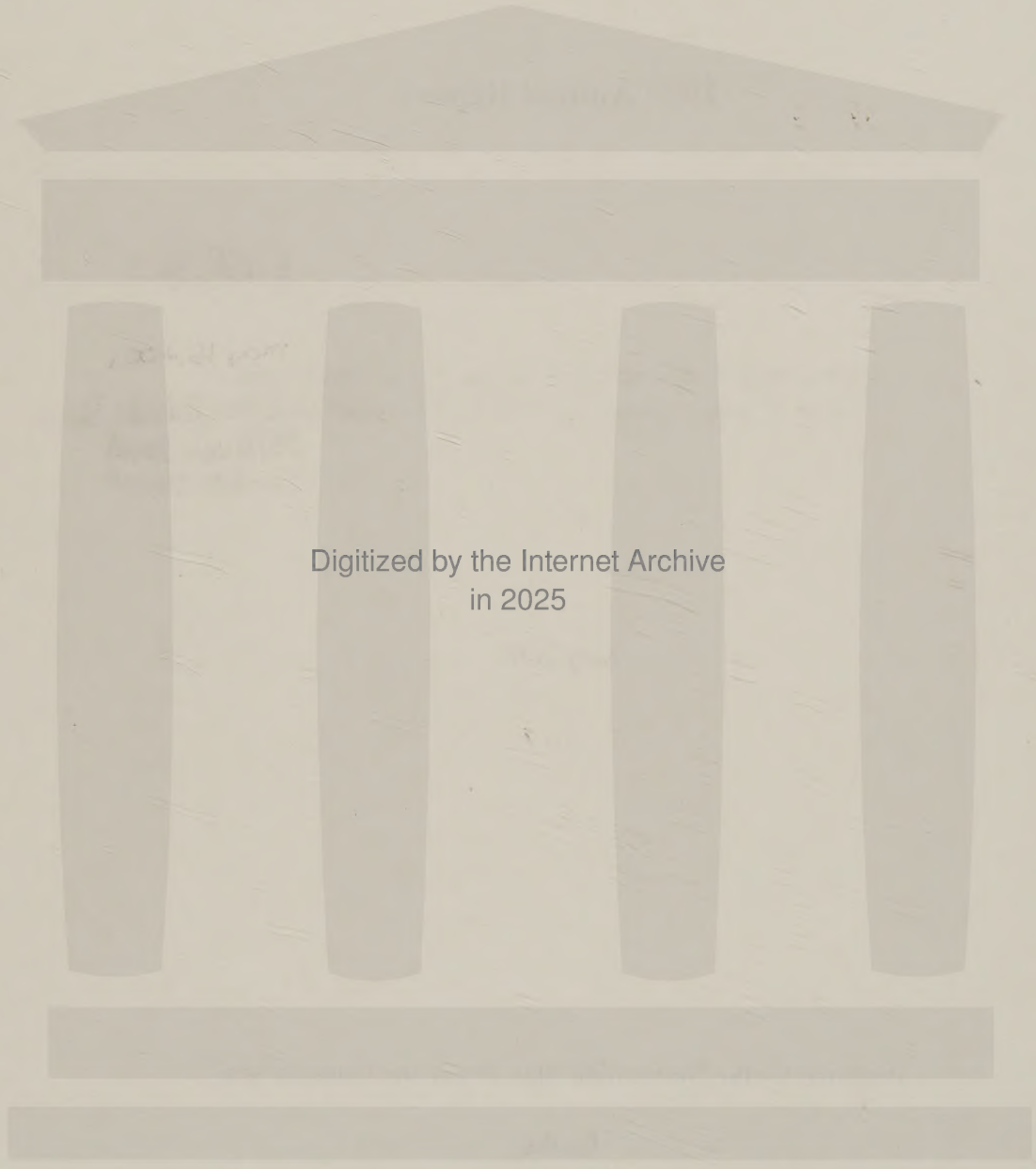

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CONTENTS

page

1.0 INTRODUCTION 1
1.1 Definition of Descriptors 1
1.1.1 Landings information 1
1.1.2 Effort information 4
1.1.3 Participation information 4
1.1.4 Economic information 4
1.2 Definition of Indicators 4
1.2.1 Aggregate Catch-Per-Unit-Effort 4
1.2.2 Mean Fish Size 5
1.2.3 Percent Immature 5
1.2.4 Spawning Potential Ratio 5
1.2.5 Economic Indicators 5

2.0 AREA SUMMARIES 5
2.1 American Samoa 5
2.1.1 Descriptors 5
2.1.2 Indicators 6
2.1.3 Recommendations 6
2.2 Guam 6
2.2.1 Descriptors 6
2.2.2 Indicators 7
2.2.3 Recommendations 7
2.3 Hawaii 9
2.3.1 Descriptors 9
2.3.2 Indicators 9
2.3.3 Recommendations 11
2.4 Northern Mariana Islands 12
2.4.1 Descriptors 12
2.4.2 Indicators 12
2.4.3 Recommendations 12
2.5 Region-Wide Recommendations 13

TABLES

1. Regional Summary of 1999 Bottomfish Statistics 2
2. Bottomfish Management Unit Species (BMUS) Names 3

APPENDICES

1. American Samoa 1-1
2. Guam 2-1
3. Hawaii 3-1
4. Northern Mariana Islands 4-1

page
5. NMFS 1999 Administrative Activities 5-1
6. USCG and NMFS 1999 Enforcement Activities 6-1
7. 1999 Bottomfish Plan Team Members 7-1
8. Glossary 8-1

SUMMARY OF ISLAND AREA TABLE OF CONTENTS

Appendix 1. American Samoa

Contents

1. Summary 1-2
2. Historical Annual Statistics 1-3
3. List of Tables 1-4
4. List of Figures 1-4
5. Introduction 1-5
6. Recommendations 1-6

Tables

1. American Samoa 1999 Estimated Total Bottomfish Landings 1-7
2. American Samoa 1999 Estimated Average Price of Bottomfish Species 1-8

Figures

1. American Samoa Bottomfish Landings 1-10
2. American Samoa annual estimated commercial bottomfish landings 1-12
3. American Samoa annual estimated bottomfish hours and trips 1-14
4. American Samoa annual estimated number of boats landing bottomfish 1-16
5. American Samoa average price of bottomfish 1-18
6. American Samoa annual bottomfish CPUE 1-20
7. American Samoa average inflation-adjusted revenue per trip landing bottomfish 1-24

Appendix 2. Guam

Context

1. Introduction 2-2
2. Summary 2-3
3. Historical Annual Statistics 2-4
4. Recommendations 2-5
5. List of Tables and Figures 2-7

Tables

1. Guam 1999 expanded creel survey composition of allocated bottomfish management unit species (BMUS) 2-8
2. Guam 1999 commercial bottomfish average price 2-9

Figures

1. Guam harvest of BMUS and all bottomfish 2-10

page
2a. Total and commercial BMUS harvest 2-13
2b.Total and commercial BMUS revenue 2-14
3. Estimated boat hours and trips 2-17
4. Guam bottomfish fishery participation 2-20
5. Average bottomfish prices 2-22
6. Guam bottomfish CPUE 2-24
7. Guam average revenue per trip 2-26

Appendix 3. Hawaii

Contents

1. Summary 3-2
2. Historical Annual Statistics 3-3
3. List of Tables 3-6
4. List of Figures 3-6
5. Introduction 3-8
6. Recommendations 3-9
7. Tables and Figures 3-10

Tables

1. Hawaii Bottomfish species landings and prices, 1998 & 1999 3-35
2. Ho'omalu zone bottomfish vessel, income statement, 2000 3-40
3. Mau zone bottomfish vessel, income statement, 2000 3-42

Figures

1. Hawaii's bottomfish landings from the NWHI and MHI 3-10
2. NWHI BMUS species composition of landings per trip by weight for the Mau and Hoomalu Zones 3-12
3. NWHI BMUS species composition of landings by weight 3-15
4. Number of trips made by NWHI bottomfish fleet, Mau and Hoomalu Zones 3-17
5. Number of vessels in the NWHI bottomfish fleet, Mau and Hoomalu Zones 3-19
6. MHI species composition of landings by weight 3-21
7. MHI reported effort and participation 3-23
8. 1998 and historical catch compostion by weight in sold catch 3-25
9. Hawaii bottomfish landings, revenue, prices, 1970-present. (Inflation adjusted) 3-26
10. Hawaii bottomfish market landings, revenue, and prices by source, 1970-present (Inflation-adjusted) 3-29
11. Hawaii bottomfish market (annual, inflation adjusted ex-vessel price and total domestic landings, 1970-present.) 3-32
12. Hawaii bottomfish ex-vessel prices by source, 1989-present (Price adjusted for inflation) 3-33
13. Hawaii bottomfish demand, 1989-present (total landings vs. price per pound, inflation adjusted) 3-37
14. NWHI bottomfish inflation-adjusted revenue per trip by zone, 1989-present 3-38
15a. CPUE for Hawaiian bottomfish 3-44

page
15b. Partial CPUE for MHI bottomfish 3-48
15c. Partial targeted CPUE for MHI bottomfish 3-51
16. Percent immature in Hawaiian bottomfish catch 3-54
17. Mean weight of Hawaiian bottomfish 3-56
18. Archipelago wide Spawning potential ratio (SPR) 3-58
19. Spawning potential ratio (SPR) for MHI bottomfish 3-60
19a. Spawning potential ratio (SPR) for MHI bottomfish using targeted CPUE 3-62
19b. Spawning potential ratio (SPR) for NWHI bottomfish using targeted CPUE 3-64
20. Research CPUE on SE Hancock Seamount 3-67
21. Armorhead Spawning potential ratio 3-70
22. CPUE for Hancock and Colahan Seamounts 3-70

Appendix 4. Commonwealth of the Northern Mariana Islands

Contents

1. Introduction 4-2
2. Summary 4-3
3. Recommendations 4-4
4. List of Tables 4-5
5. List of Figures 4-5

Tables

1. CNMI Consumer Price Indices 4-6
2. CNMI 1999 commercial landings of bottomfish species 4-7

Figures

1. CNMI commercial bottomfish landings and revenue 4-8
2. Number of fishermen (boats) making bottomfish landings 4-10
3. Number of CNMI bottomfish trips 4-12
4. CNMI average price of bottomfish 4-14
5. CNMI average inflation adjusted revenue per trip landing bottomfish 4-15
6. CNMI bottomfish catch in average pounds per trip 4-17

Bottomfish and Seamount Groundfish Fisheries of the Western Pacific

1999 Annual Report

1.0 INTRODUCTION

The 1999 annual report provides a set of descriptors and indicators of the bottomfish fisheries from American Samoa, Guam, Hawaii and the Northern Mariana Islands. The descriptors are designed to document recent trends in landings, effort, participation, revenue and prices. Should management action be recommended, descriptor information will aid in assessing potential impacts of the action on fishery participants. The indicators are quantifiable and measurable tools used to identify signs of stress in the stocks or the fishery. Based on changes over time in indicator levels, the Bottomfish Plan Team (BPT) may identify "yellow light" situations (i.e., where stress is first detected) and recommend that either management action or additional study be undertaken or "red light" situations where immediate management action is needed.

The annual report is organized as follows: The introduction section defines and briefly explains the descriptors and indicators. The next section briefly summarizes time trends in descriptor and indicator levels, through the current year, and recommends any areas of concern for each island area. Reports from each island area are appended. The introduction describes the history and present characteristics of the fishery. Results of the current year's descriptors and indicators are presented in detail, in relation to past temporal trends. Figures are supported with information on source of the data, methods of calculation, and data interpretation. Table 1 summarizes 1999 bottomfish statistics for the region. The appended report from each area includes a summary, which addresses progress made on the previous year's recommendations, and lists new recommendations. Finally, additional appendices contain information on NMFS 1999 administrative and enforcement activities, habitat conditions, protected species interactions, and 1999 BPT membership.

Table 2 lists scientific, common English and local/indigenous names for bottomfish management unit species (BMUS) for each area (American Samoa, Guam/Northern Marianas, and Hawaii).

1.1 Definition of Descriptors

The fishery descriptors are defined as follows:

1.1.1 Landings information

Time series information on aggregate catch for each island area shows recent trends in total bottomfish harvest. For American Samoa and Guam, estimates of both the commercial landings and the total landings (combined commercial, recreational and subsistence) are available. For Hawaii and the Northern Marianas, landings information represents only the commercial harvest.

Table 1. Regional Summary of 1999 Bottomfish Species

				Hawaii			
	AS	GU	NMI	All	MHI	Mau	Hoomalu
BMUS Landings (lb)	17,388	52,662	44,415	697,000	374,000	54,000	269,000
Revenue ($)	38,623*	42,966*	161,007	2,486,000	1,517,000	182,000	970,000
No. Of Boats	19	411	50	---	412	7	6
No. Of Trips	122	9,479	283	---	2,499	30	48
CPUE	12.9 lb/hr	3.2 lb/hr	157 lb/trip	---	211 lb/trip	2,899 lb/trip	4,606 lb/trip
SPR	0.41	---	---	0.34-0.59	note 1	note 2	note 2

*_American Samoa's revenue based on commercial landing of 15,123 pounds, Guam's revenue based on commercial landing of 13,011pounds

Notes:

1) Species with Spawning Potential Ratio near or below threshold level of 0.20, indicating localized subarea depletion: MHI onaga ("targeted" SPR = 0.07); MHI ehu ("targeted" SPR = 0.06); MHI hapuupuu ("best/worst" SPR = 0.30)
2) Healthy (SPR > 0.20) for all species (Mau Zone=0.52, Hoomalu Zone=0.78)
3) Revenue for NWHI zones combined was $1,102,000

Table 2. Bottomfish Management Unit Species (BMUS) Names

(Absence of an indigenous name implies no local name established or area is not within the species' geographic range.)

Scientific	English Common	American Samoa	Guam/CNMI	Hawaii
Bottomfish:				
Aphareus rutilans	red snapper/silvermouth	palu-gutusiliva	maraap tatoong	lehi
Aprion virescens	gray snapper/jobfish	asoama	tosan	uku
Caranx ignobilis	giant trevally/jack	sapoanae	tarakito	white ulua/pau'u
C. lugubris	black trevally/jack	tafauli	trankiton attilong	black ulua
Epinephelus fasciatus	blacktip gouper	fausi	gadao matai	
E. quernus	sea bass			hapu'upuu
Etelis carbunculus	red snapper	palu-malau	guihan boninas	ehu
E. coruscans	red snapper	palu-loa	onaga	onaga
Lethrinus amboinensis	ambon emperor	filoa-gutumumu	mafuti/lililok	
L. rubrioperculatus	redgill emperor	filoa-pa'o'omumu	mafuti tatdong	
Lutjanus kasmira	blueline snapper	savane	sas/funai	ta'ape
Pristipomoides auricilla	yellowtail snapper	palu-i'usama	guihan boninas	yellowtail kalekale
P. filamentosus	pink snapper	palu-'ena'ena	guihan boninas	opakapaka
P. flavipinnis	yelloweye snapper	palu-sina	guihan boninas	yelloweye opakapaka
P. seiboldi	pink snapper		guihan boninas	kalekale
P. zonatus	snapper	palu-sega	guihan boninas/gindai	gindai
Pseudocaranx dentex	thicklip trevally		terakito	butaguchi/pig ulua
Seriola dumerili	amberjack		guihan tatdong	kahala
Variola louti	lunartail grouper	papa	bueli	
Seamount Groundfish:				
Beryx splendens	alfonsin			kinmedai (Japanese)
Hyperoglyphe japonica	ratfish/butterfish			medai (Jap.)
Pseudopentaceros richardsoni	armorhead			kusakari tsubodai (Jap.)

In Hawaii, changes in species catch composition are provided for the Main Hawaiian Islands (MHI) and the Northwestern Hawaiian Islands (NWHI). Statistical tests for consistency in catch composition over time and between areas are included. Where possible, descriptor information has been presented for each NWHI management zone: Hoomalu and Mau. For 1999, pounds landed by species are presented in tabular form for each area except Hawaii. For Hawaii, NWHI BMUS landings by species are provided for 1986 through 1999.

1.1.2 Effort information

Effort is measured in number of trips for Hawaii and the Northern Marianas, and in both hours fished and trips taken for American Samoa and Guam.

1.1.3 Participation information

Estimates of the number of vessels making bottomfish landings are provided for all areas.

1.1.4 Economic information

Time trends in economic performance are characterized by plots of total ex-vessel revenue, aggregate average price levels, and for Hawaii, price trends over time for major species. In time-series of prices and revenues, it is appropriate to adjust value for the rate of inflation so that values throughout the time period are comparable (based on a consistent purchasing power for the dollar). Both the unadjusted and adjusted aggregate average price and aggregate revenues are plotted to clarify the relative change over time.

1.2 Definition of Indicators

Indicators were developed as tools for identifying signs of stress in the stocks or the fishery which deserve further investigation and/or a management response. Analyses consider how the indicators change over time. Indicators for Hawaii include 95% confidence intervals. To the degree possible, similar variance estimates are expected from the other areas in future annual reports. The indicators are defined as follows:

1.2.1 Aggregate Catch-Per-Unit-Effort

If the current year's aggregate catch-per-unit-effort (CPUE) is less than 50% of the average aggregate CPUE for the first three years of available data, there may be cause for concern. CPUE information is available for all areas; research CPUE is available for SE Hancock Seamount for all years since 1985, except in 1992 and 1994-1999.

1.2.2 Mean Fish Size

If there has been a significant reduction in mean fish size for a species over time, the stock may be stressed by the fishery. Mean size information is provided for nine species in Hawaii.

No mean size information was available at this time for American Samoa, Guam or the Northern Marianas.

1.2.3 Percent Immature

If over 50% of the catch for a species is below the size of first maturity, the stock may be stressed by the fishery. Information for this indicator by species is available only from Hawaii.

1.2.4 Spawning Potential Ratio

The spawning potential ratio (SPR) is the ratio of the spawning stock biomass per recruit, at the current level of fishing, to the spawning stock biomass per recruit that would occur in the absence of fishing. According to the overfishing definition contained in the Bottomfish FMP (Amendment 3, 1990), if SPR is less than or equal to 0.20, recruitment overfishing has occurred (i.e., spawners have been reduced to 20%, or less, of their unexploited stock level). Data to calculate SPR were not available from Guam or the Northern Marianas. An estimate of the "worst case" SPR was calculated for American Samoa's bottomfish complex using Dory Project data to estimate the virgin population CPUE and information on percent of immature fish from Hawaii. In Hawaii, SPR was calculated for five major species in the Hoomalu and Mau Zones, of the NWHI, and the MHI; some SPR values changed slightly from previous year's reports due to improvement in the calculations. SPR for armorhead was calculated annually since 1985, except for 1992 and 1994-1999.

1.2.5 Economic Indicators

Revenue per trip plots are presented for all areas except the MHI. A more valuable indicator for the commercial fisheries, which may be available in the future, would be net revenue (ex-vessel revenue minus costs per trip). Net revenue is available only from the Hoomalu Zone and Mau Zone in Hawaii.

2.0 AREA SUMMARIES

2.1 American Samoa

2.1.1 Descriptors

Bottomfish landings, which declined from 1988 to 1992, rose slightly in 1993 and dramatically in 1994. The decline was attributed to the following: the three hurricanes that struck the territory (in 1987, 1990 and 1991), the departure of several highliners from the fishery, the shift in importance from bottomfishing to trolling, and the substitution of imported fish from Western Samoa and Tonga. The significantly greater 1994 total landings, when compared to the previous years, occurred primarily due to improved catch recording, an increase in effort by highline vessels, and a high fish demand for government and cultural events. In 1998, total landing dropped 60% from the 1997 landings, recovering only 10% in 1999. 1999 total landings

were only 34% of the 18-year average. The declining trend in total landings since 1996 is mainly due to the reduction of bottomfish fishing effort by highlighers to more profitable longlining methods.

Fishing effort, measured by the number of trips, increased 22% in 1999 but represents only 36% of the long term average. Again, this continued lower effort is due to fishermen seeking other more stable and lucrative lines or work, reflected by the relatively lower total number of boats in 1999 of 19, 73% of the 18-year average.

The average price per pound decreased slightly to $2.55 in 1999 after three years of increases. The decrease in price may be due to a 22% increase in imports of lower quality bottomfish from western Samoa. Nevertheless, inflation-adjusted prices have been relatively stable since 1985.

2.1.2 Indicators

CPUE (pounds per hour), though relatively stable (at about 10 lb/hr) in the early 1990's, increased in 1996 to 14.8 lb/hr, mainly due to improved sampling. CPUE declined by about 7% for the second straight year in 1999 to 12.9 lb/hr. This level is not less than 50% of the average aggregate CPUE for the first three years of available data (9.7 lb/hr), indicating no cause for concern. The proxy "worst case" SPR was 0.41 in 1999, indicating that recruitment overfishing has not occurred. Size and maturity data were collected from key species, but insufficient sample sizes were available for a more realistic SPR estimate. Bottomfish revenue per trip (as opposed to total revenue) remained stable for the third straight year in 1999, after a three-year declining trend.

2.1.3 Recommendations

With the growing number of boats based on the island of Aunu'u, it is recommended that an Aunu'u-based DMWR sampler, similar to those based in Manu'a, be hired to collect fisheries data from all the Aunu'u-based fishing fleet.
[Note: Catch and effort data for the Aunu'u-based fishing fleet has been estimated in the past through the use of a proportional adjustment factor (P2) in the data expansion algorithms.]

2.2 Guam

2.2.1 Descriptors

The fairly large fluctuations over time in bottomfish landings in Guam appear to be due more to entry and exit patterns of fishermen, rather than changes in fish stocks. The number of highliners fishing in the area doubled from 1993 to 1994, increasing the total commercial BMUS harvest and revenue by nearly 300% during that year. In 1999, the total BMUS landings increased by 46%, making 1999 the fourth highest BMUS landings in the 15 year data history and 25% above the 15-year average.

The recent increase in total BMUS prior to 1999 is due primarily to an increase in recreational and subsistence-type boats participating in the fishery. The 1995 total number of boat hours and trips increased nearly 175% due to the recreational and subsistence-type boats and the calm seas throughout most of 1995, which allowed many of them to participate in bottomfishing more often than usual. The general increasing trend began in 1986. The slight declines in boat hours and trips in 1996 and 1997 may have been the result of the almost complete absence of highliners participating in the fishery. The increase in the BMUS harvest in 1999 is due to the few highliner fishermen concentrating on the deep-water bottomfish fishery.

The adjusted average price for bottomfish has not shown consistent marketing trends. This is believed to have resulted from the seasonal supply of pelagic fish and difficulties in developing a consistent market for locally caught fish. In addition, imported fish from other islands around the region have contributed to the continued marketing problem for local fishermen. The 1999 inflation-adjusted average bottomfish price of $3.61 continues a 34% four year increase and is up 10% from 1998 ($3.30). The 1999 average price is still only 85% of the long term average and may explain why local highliners have been rare in the bottomfish fishery in recent years.

2.2.2 Indicators

In 1999, the CPUE recovered somewhat from the 1998 historical low of 2.5 lb per hour. Recalculations of the aggregate catch-per-unit-effort average for the first three years of data collection on Guam decreased the value from 6.9 lb/hr to 5.6 lb/hr and thus the 1999 CPUE of 3.2 lb/hr does not indicate a "yellow light" condition as it would have given the earlier calculation. Thus, this does not require investigation or a management response. Nevertheless, a continuing declining CPUE, decrease in fish average size, and local fishermen's concerns are indicators that the fishery is stressed.

The adjusted average revenue per trip does not appear to show any long-term trend or cause for concern. The substantial increases in both actual and inflation adjusted revenue per trip occurring in 1994 are best explained by the success of the highliner vessels. The 1995 increase in revenue for all species landed verses the decrease in revenue for bottomfish only, indicated that on average, most commercial fishermen continue to make more money from their trolling efforts than from bottomfishing. The 1996-99 values are representative of the long-term mean.

2.2.3 Recommendations

Status of 1998 recommendations:

Recommendation 1:

The new expansion algorithms show that Guam's bottomfish fishery rebounded a "yellow light" condition in 1998. The non-charter boat bottomfishing CPUE does not fall within the "yellow light" condition. However, the data from the new expansion process can only be considered preliminary. The new offshore expansion program should be nearly completed, and a more accurate picture of Guam's bottomfish fishery should be available.

Recommendation 2:

Currently, verification of the offshore fishery data from 1985 to the present is nearly complete. Data from 1980 to 1984 will be inputted and verified by DAWR staff, then the whole time series reprocessed in order to provide a consistent time line in this module . Problems with historical data do exist, especially in interpreting for various strata that is currently being collected, but progress made with the 1985 data can be applied to earlier years.

Recommendation 3:

The biologist leading the baseline biological survey of the red-gill emperor has left Guam's Fisheries staff. A new DAWR staff should being assigned to complete the red-gill emperor research project, by possibly next year.

Recommendation 4:

DAWR and NMFS staff will continue to work towards establishing mean fish size, percent immature, and SPR indicators for Guam's deep and shallow bottomfishing complexes. Guam's offshore creel census collects size information to the species level from bottomfishing activity, both shallow and deep, encountered during creel surveys, and progress is being made to be able to expand for both the shallow and deep complexes

1999 Recommendations:

1)The data presented should only be considered preliminary, although great strides have been made to verify the historical data and create a program able to expand the offshore data in a consistent manner although offshore creel surveys have changed over the years. Efforts should continue to develop and fine-tune the database computer program that will provide DAWR with the capability of integrating the offshore survey expansion data with the inshore expansion data, and additionally produce statistics of confidence, a compilation of biological data, and a complete species composition analysis according to Plan Team requirements. Upon completion of the computer program, designated DAWR staff should be trained to use the new software to reprocess creel survey data from 1980 to present. Training should also be provided to teach staff how to interface with NMFS/WPacFIN software. Such training would facilitate additional support from NMFS/WPacFIN in the processing and analysis of fisheries data if necessary.

2) The need to complete the baseline biological survey of the red-gill emperor, *Lethrinus rubrioperculatus*, remains as the single most important data deficiency for the Marianas shallow-water bottomfish resource. DAWR should assigned another biologist to this project, and attempt to complete this project as soon as possible.

3) With additional funding from the WPacFIN program and technical assistance from the NMFS, DAWR should establish mean fish size, percent immature and SPR indicators for Guam's deep- and shallow-water bottomfish complexes.

2.3 Hawaii

2.3.1 Descriptors

Main Hawaiian Islands: Only commercial data are available for both the MHI and NWHI fisheries, even though the MHI recreational/subsistence catch is estimated to be about equal that of commercial landings. In 1988, there was a dramatic increase in MHI bottomfish landings due to a bonanza uku (gray snapper) harvest. A steady decline in total landings occurred until 1993, which was the lowest recorded annual value. Landings increased 32% in 1994 and remained high through 1997, although CPUE was at a 12 year low in 1997. Participation and landings have declined over the past two years while CPUE has increased 29% in that same period. 1999 landings of 374,000 pounds are the second lowest total landings in recent records and may be correlated to a 17% decrease in the total number of trips.

Total ex-vessel revenue from the MHI shows a general decline from 1988-1996 and has stabilized since. 1998 inflation adjusted revenue was the lowest since 1974, and one-third of 1988's value. Revenue increased 14% in 1999, but still remains low for recent years.

NWHI Mau Zone: Mau Zone 1999 landings decreased 18% from 1998 due to a 23% decrease in number of trips from 39 in 1998 to 30 in 1999. Catch per trip increased by 7% in this zone. The total number of boats remained stable at 7.

NWHI Hoomalu Zone: Hoomalu Zone 1999 landings increased 1% from 1998. Six boats fished in 1999, one less than in 1998. The number of trips decreased by 4% from 50 to 48. Bottomfish landings per trip increased by 5% based on NMFS CPUE.

Available revenue data are not separated by zone. Overall NWHI inflation adjusted revenue had been relatively stable. With the 24% decline in 1998 being recovered with a corresponding increase in 1999. This large fluctuation was mostly caused by the yo-yo affect of the the inflation adjusted average bottomfish price in these two years.

2.3.2 Indicators

Hawaii Archipelago-wide:

SPR values for the five major BMUS species in 1999 are all above the 20% critical threshold level, that defines recruitment overfishing under the FMP, when viewed on an archipelago-wide basis. Of these species, onaga is still the lowest, although the 1999 value increased by 50% over the 1998 value to 34%. Implementation of the state's management plan should help improve the condition of onaga in the MHI and continue to increase the archipelago-wide SPR.

SPR values are also presented on a management zone basis (MHI, Mau Zone, Hoomalu Zone) for the purpose of determining locally depleted resources.

MHI: CPUE in 1999 continued to rebound from its lowest level on record in 1997, increasing 9% and 14% in 1998 and 1999, respectively. Recent CPUE values are approximately one-fourth the early (baseline 1948-50) values, signifying local depletion in the MHI. The decline is most apparent in ehu, with a recent CPUE of only about 5% that of the initial years of the fishery. The increase in the late 1980's MHI CPUE was primarily due to a large increase in uku catches, and may not indicate an increase in abundance in other species. Most of the more commercially important species in the MHI have had relatively stable mean weights since 1984. Hapuupuu's mean weight dropped sharply in 1993 and has continued to be low. While sample size is low, size of hapuupuu may have declined in the MHI. The most important change in 1999 is a second year of increased size in the MHI ehu.

For the seventh year 95% confidence intervals were constructed based on "best" and "worst" case bounds of SPR components (CPUE and percent immature). For the fifth year SPR values were calculated using both aggregate CPUE, as in previous years, and targeted CPUE, which gives a more accurate picture for individual species. 1999 aggregate CPUE SPR values for all five major species are marked improvements over critically low levels: onaga (0.08), opakapaka (0.24), hapuupuu (0.30), ehu (0.32), and uku (0.32). The use of targeted CPUE showed a different picture for the four species where targeted trips are available. Here, ehu and onaga SPRs are much worse than indicated using aggregate CPUE (SPR = 0.06 and 0.07, respectively), whereas SPR values for opakapaka and uku are much higher than previously indicated (SPR = 0.31 and 0.56, respectively). Onaga's SPR has now been below 0.20 for 8 of the past 9 years and ehu for all of the last 9 years (using targeted CPUE).

NWHI Mau Zone: The NMFS CPUE data are only available for the NWHI fishery as a whole since 1984 and by zone since 1988. The NWHI (combined Mau and Hoomalu Zones) NMFS CPUE steadily decreased from 1987 to 1992, rose in 1993, and then declined from 1994-96. CPUE rose in 1997 to the 1993-94 level, but dropped slightly in 1998. CPUE remained essentially the same in 1999 at 486 lb/day . The Mau Zone NMFS CPUE had been steadily decreasing since 1989, but increased in 1993 and 1994. In 1997, NMFS CPUE rose 49%. The CPUE declined 15% in 1998 and 7% in 1999 to 337 lb/day. The Mau Zone HDAR CPUE increased 15% in 1999 to 2899 lb/trip, but remains only 60% its 50-year average. Non-parametric 95% confidence intervals were calculated for HDAR CPUEs by the "bootstrapping" method. Mean weights of fish in the Mau Zone continue to exhibit year to year fluctuations, but are generally at much higher values than MHI mean weights. The percent of immature fish in the 1999 Mau Zone catch was still safely under 50% for all species evaluated, except onaga, which dropped to just under 50% from a "yellow light" condition in 1998.

SPR values in the Mau Zone have been decreasing since 1990 (mirroring the pattern in the HDAR CPUE), experienced a surprising rise in 1994, returned to lower levels in 1995, followed by a continued four year increase through 1999. All values are presently above 0.50, well above the critical level of 0.20. SPR values are higher in the NWHI than the MHI because most of the catch is mature fish. SPR values in both NWHI zones have never fallen below 0.35.

NWHI Hoomalu Zone: The Hoomalu Zone NMFS CPUE has been on a downward trend from since data collection began in 1988. 1999 CPUE increased only slightly to 534 lb/day from

an 11-year low in 1998. The Hoomalu Zone HDAR CPUE followed an increasing trend, but dropped sharply in 1994 for unclear reasons, rose by 20% in 1995 and has remained stable through 1998. Pounds per trip declined by 11% in 1999. Mean weights of fish in the Hoomalu Zone continued to exhibit year to year fluctuations, but are still at much higher values than MHI mean weights. The percent of immature fish in the 1999 catch was still safely under 50% for all species evaluated, except for onaga, which dropped just below a "yellow light" condition after two years above 50%.

The SPR values in the Hoomalu Zone remained dropped slightly for all species except onaga, which increased 33% to 54% in 1999. Other species 1999 SPR levels range from 64% to 66%.

Seamount Groundfish (Armorhead): No fishing has been allowed on the armorhead stocks of the SE Hancock Seamount since the moratorium began in August, 1986. The 1993 CPUE, calculated from research longline catches, was more than double that of the last assessment (in 1991) and nearly as high as the highest CPUE recorded since surveying began in 1985. No research cruise occurred since 1993, and future research assessment cruises are unlikely.

No SPR values were available in 1999 as no research was undertaken. In 1993, SPR within the EEZ (SE Hancock Seamount) was above 0.02, the highest since 1986, but still far below (10% of) the threshold level for recruitment overfishing of 0.20. About 99% of the known armorhead seamount habitat occurs outside the U.S. EEZ, an area which had 0.06 SPR in 1993. During February and March 1997, an oceanic and larval armorhead survey over the seamounts outside the U.S. EEZ was conducted onboard the R/V Kaiyo Maru by the National Research Institute of Far Seas Fisheries Laboratory in Shimizu, Japan. Armorhead larvae were collected from surface waters around all seamounts except for Koko Seamount.

2.3.3 Recommendations

1998 Recommendations

1) The BPT recommends that the Council amend the FMP to become fully consistent with the State of Hawaii Administrative Rule 13-94 on MHI bottomfish. This would include closure of areas within the federal jurisdiction as specified in the administrative rule.

Status: The Council elected to not pursue these amendments to the Bottomfish FMP due to adequate level of enforcement already occurring.

2) The BPT recommends that the Council encourage and assist the State of Hawaii DLNR in the implementation of a postcard survey of non-commercial bottomfish fishermen as determined from the State's BF vessel identification permit list. This survey would be used to estimate recreational catch of bottomfish in the MHI.

Status: This issue is under consideration by the recently formed Recreational Fishing Task Force.

1999 Recommendations

There were no recommendations from the Bottomfish Plan Team as of their April 1999 meeting.

2.4 Northern Mariana Islands

2.4.1 Descriptors

Data are available only on the commercial fishery. The declining trend in landings and revenues, which occurred from 1988-91, was reversed by a growth trend which began in 1992. In 1999, bottomfish landings remained high at 44,415 lb, and exceeded the 1994 landings by 125%, due primarily to the growth of the local bottomfishing industry, particularly from new ventures operating full time. The 1994 increase was in vessels of all sizes, including large (50 ft plus) vessels. In 1999, the number of vessels fishing remained at 50 following the 1998 drop from 68. The number of trips decreased 11% in 1999 to 283 which equaled the long term average. Many of these trips were regularly scheduled long trips to the Northern Islands, where bottomfish are more abundant.

The average adjusted price per pound received for bottomfish has increased over the past three years and 1999 average price was at a 17-year high. Nonetheless, because prices have been relatively stable, the $3.63 is only 16% greater than the long term average. The total 1999 ex-vessel revenue remained high at $161,007. The 4-year sustained high levels of landings and revenue are attributed to expanded bottomfish operations.

2.4.2 Indicators

The average bottomfish catch per trip continued its 9-year increasing trend to 157 lb/trip in 1999. Landings per trip have increased by 340% since 1991. The average catch per trip is subject to significant biases (e.g., changes in trip length and relative amounts of bottomfishing compared to trolling). It may be possible to improve this measure of CPUE by using only those trips which landed bottomfish species exclusively. While such a calculation may be sensitive to other biases due to small sample size, it should be investigated in the future. This indicator does not suggest the need for any management action.

Revenue obtained from bottomfish sales has remained in step with the increases in landings since 1991. 1999 inflation-adjusted revenue per trip has also seen an equivalent 350% increase since 1991, reaching an all-time high. The average revenue per bottomfish trip in 1999 increased 13% for bottomfish species and 6% for all species, continuing an 9-year trend. All species inflation adjusted revenue, which had been declining from 1988 to 1992, has since made a strong 5-year rise. Bottomfishermen often troll to and from the bottomfishing site, thus acquiring a mixed catch after spending the day "bottomfishing".

2.4.3 Recommendations

1) To request NMFS and the Council to assist DFW in adequately assessing the status of bottomfish stocks in the southern islands of CNMI. (Same as last year)

2) Establish baseline (virgin stock) parameters (CPUE, percent immature) for the Guam/Northern Marianas deep-water bottomfish complex (e.g., survey on grouper, snapper) utilizing data collected during Resource Assessment Investigation of the Marianas Archipelago (RAIOMA) cruises (1981-1984), the current fishing in the Northern Islands and sampling aboard DFW research vessel to help calculate SPR, with assistance from NMFS. (Same as previous years)

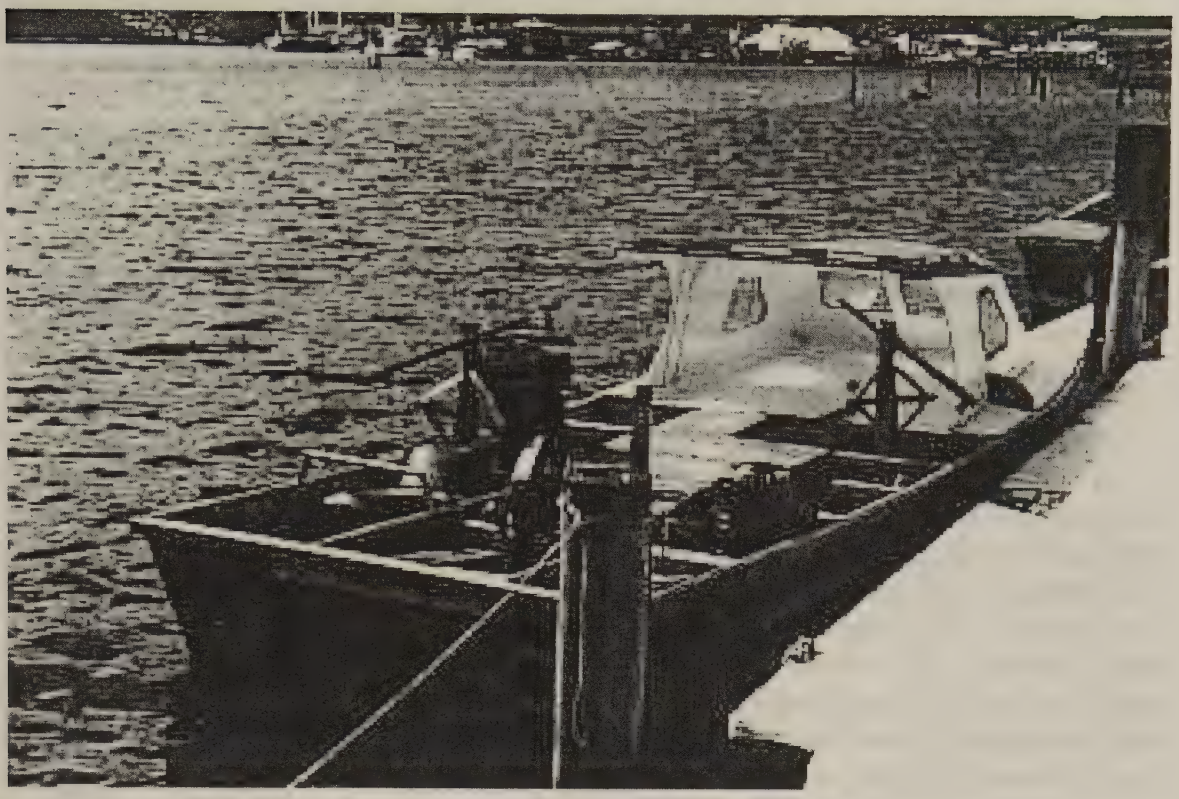
3) Establish baseline (virgin stock) parameters (CPUE, percent immature) for the Guam/Northern Marianas shallow-water bottomfish complex (e.g. red-gilled emperor) by sampling program aboard DFW research vessel to help calculate SPR, with assistance from NMFS. (Same as previous years)

4) With assistance from NMFS/WPacFIN, software should be developed and implemented to separate fishery statistics for the main islands fishery and from the Northen Islands fishery with separate descriptions and statistics reported in the annual report module. (Same as previous years)

2.5 Region-Wide Recommendations 1999

There were no recommendations from the Bottomfish Plan Team as of their April 1999 meeting.

American Samoa



CONTENTS

Page

Summary 2

Historical Annual Statistics 3

List of Tables 4

List of Figures 4

Introduction 5

Recommendations 6

Tables 7

Figures 10

Summary

The fishery was relatively bigger between 1982 and 1986 than in recent years (Figure 1). This observation reflects a trend in the loss of skilled and full-time commercial fishermen from the fishery, gradual depletion of newly discovered banks (e.g., 2% Bank), the shift of preference from bottomfishing to trolling and, recently, the diversion of effort by the highliner bottomfish fishermen towards longlining. The December 1992 hurricane contributed to the slight 1992 decrease in landings (Figure 1) and the lowest number of trips recorded for the period 1982-1991 (Figure 3). Compared to the 1982-1986 period (there was a hurricane in 1987), the past five years' landings, effort and subsequently revenues were notably less. This is mainly due to the highliners diverting their efforts towards the more profitable longlining method and the unattractive prices resulting from the influx of imported bottomfish from Western Samoa.

During 1999, a total of 19 local boats landed an estimated 17,400 pounds of bottomfish in the territory. Revenue for the domestic commercial fishery this year was estimated around $38,600 with all catch being sold locally. The CPUE for 1999 (12.9lb/hr) was not less than 50% of the aggregate CPUE for the first 3 years of available data and in fact was above the long term average CPUE for this fishery. Additionally, a proxy "estimate of the worst case" SPR of 0.41 (analysis not presented and not required) indicated that recruitment overfishing is not occurring in this fishery. In 1999, a 22% increase in bottomfish trips parallels the slight increase in the number of boats (Figure 4). Overall average prices, however, dropped this year but prices for Onaga and Ehu increased mainly due to their demand by new outlets. The increase in effort during this year can be attributed to a few new boats entering this fishery. Last year's decline in landings and effort is mainly due to the significant drop in the number of boats participating in this fishery and the increase in participation of local fishermen in the relatively newer and profitable longlining method. Indicators derived from current data do not dictate a need for any management response at this time.

Regarding some of the SFA amendments: ***Commercial*** Bottomfish Landings and Revenues statistics for American Samoa is presented in Figure 2. Only one boat made a mixed trolling and bottomfish ***Recreational*** trip this year landing 102 pounds of which 90 pounds were skipjack. **Recreational** fishing is more associated with the pelagic fisheries and usually never occur in this fishery. There was no ***chartered*** bottomfish trip during this year. DMWR added a field in the Offshore Creel Survey Interview Form to start recording **bycatch data. No bottomfish bycatch was recorded this year.** In the *Preliminary Draft of EFH, Amendment for Bottomfish, WPRFMC Feb.1998,* **the approximate MSY estimate for American Samoa** [196 nautical miles 100-fathom isobath] was estimated at 79,000 lbs. per year. Total bottomfish landings estimated for this year was only 17,400 pounds.

The following selected annual statistics, now including CPI data, dating back to 1982 provides a brief historical snapshot of American Samoa's bottomfish fishery.

Selected Historical Annual Statistics

Years	*Total Landing (lbs.)*	*CPUE (Lb./hr)*	*Revenue Inflat. Adjust.*	*$/lb Inflat. Adjust.*	*CPI*	*Number of Boats*
1982	64942	8.5	181771	2.93	100.0	27
1983	126327	10.0	427035	3.41	100.8	38
1984	94104	10.7	259890	2.80	102.7	48
1985	143225	8.1	218185	2.13	103.7	47
1986	96031	8.8	213056	2.24	107.1	34
1987	31148	11.7	66545	2.18	111.8	20
1988	71067	22.9	156755	2.32	115.3	26
1989	47487	16.7	74124	2.05	120.3	29
1990	14527	9.3	26010	2.05	129.6	19
1991	18558	9.1	37607	2.13	135.3	20
1992	13144	9.3	29940	2.28	140.9	14
1993	17394	7.3	31673	2.05	141.4	22
1994	44869	7.7	94648	2.29	143.8	19
1995	35209	9.8	70572	2.03	147.0	25
1996	38454	14.8	76248	2.01	152.5	26
1997	39863	14.7	84015	2.19	156.3	24
1998	15862	14.0	40156	2.79	158.4	16
1999	17388	12.9	38623	2.55	160.0	19
Average	51644	11.5	118158	2.36		26
STD	39808	4.0	106560	0.39		10

Tables

Page

1. American Samoa 1999 Estimated Total Bottomfish Landings.....7

2. American Samoa 1999 Estimated Commercial Landings by Species.....8

Figures

Page

1. American Samoa Bottomfish Landings.....9

2. American Samoa Annual Estimated Commercial Bottomfish Landings..10

3. American Samoa Annual Estimated Bottomfish Hours and Trips.....13

4. American Samoa Annual Est. Number of Boats Landing Bottomfish.....15

5....American Samoa Annual Bottomfish Average Price of Bottomfish.....17

6....American Samoa Annual Bottomfish CPUE.....19

7. American Samoa Average Inflation-Adjusted Revenue per Trip Landing Bottomfish 21

Introduction

Bottomfishing from canoes by the indigenous residents of the American Samoa islands has been a subsistence traditional practice since the distant past. It was not until the early 1970's that the bottomfish fishery developed into a commercial venture utilizing motorized boats. A government subsidized program, called the Dory Project, was initiated in 1972 to develop the offshore fisheries into a commercial venture, and resulted in an abrupt increase in the fishing fleet and total landings. In 1982, a fisheries development project aimed at exporting high-priced deep-water snappers to Hawaii caused another notable increase in both bottomfish landings and revenue. Between 1982 and 1988, the botttomfish fishery comprised as much as 50% (by weight) of the total commercial landings. Beginning in 1988, the nature of American Samoa's fisheries changed dramatically with a shift in importance from bottomfish fishing towards trolling. In the past four years, the dominant (by weight of fish landed) fishing method has been longlining.

During the early 1980's, fisheries data were collected from the bottomfish fishery by interviewing only commercial vessels. In the current Offshore Creel Survey on Tutuila that started on October 1, 1985, commercial, subsistence and recreational domestic fishing boats landing catch in five designated areas were interviewed and their catch recorded. For two weekdays and one weekend/holiday per week, DMWR technicians normally sampled offshore trips between 0500 and 2100 hours. Two DMWR samplers based on Tau and Ofu collect fisheries data from the Manu'a islands fleet.

Boat-based fishing in American Samoa used to be mainly trolling and/or bottomfish. In the past four years, record longlining landings (mainly by the Alia commercial fishermen) were recorded with revenues approaching the one million-dollar mark. Bigger boats are entering the fisheries but these are rigged for longlining and more of these are expected to enter the territory's longline fishery. The bottomfish fishery of American Samoa was typically commercial overnight bottomfish handlining using skipjack as bait, on 28-30 foot aluminum alias (typical bottomfish alia photo on cover). Lower quality bottomfish imported from western Samoa helps satisfy the demand for bottomfish but at the same time result in unattractive prices for local bottomfish fishermen. The adverse effects of three hurricanes that struck American Samoa in 1987, 1990 and 1991 can be seen in some of the trends in the fishery as depicted by the data in this report.

New Windows/FoxPro-based data processing/analysis computer programs developed by the Central WPacFIN staff were utilized this year to re-process and re-analyze all the historical fisheries data presented in all previous Plan Team Annual Reports. As anticipated, most numbers have changed but the overall trends in this fishery presented using these new WPacFIN systems remained similar to those obtained from the former DOS/dBase data processing systems, and presented in past Plan Team reports. Continued modifications and improvements of these new Windows/FoxPro computer programs and the historical data base has resulted in obtaining processed data that better represent the status of the territory's bottomfish fishery.

Recommendations

1998 Recommendation:
According to DMWR Chief Biologist, DMWR will begin collecting appropriate data to calculate a more realistic SPR estimate for American Samoa's bottomfish complex in 1999, as recommended by the Bottomfish Plan Team in the past two years.

Status of Recommendation:
DMWR's Chief Biologist resigned in November 1999 and the status of this project is unknown. Since the Bottomfish Plan Team has replaced SPR analysis with new SFA amendments, SPR related data might still be collected and used for other fisheries monitoring and management projects.

1999 Recommendation:
With the growing number of boats based on the island of Aunu'u, it is recommended that an Aunu'u-based DMWR sampler, similar to those based in Manu'a, be hired to collect fisheries data from all the Aunu'u-based fishing fleet.
[Note: *Catch and effort data for the Aunu'u-based fishing fleet has been estimated in the past through the use of a proportional adjustment factor (P2) in the data expansion algorithms.*]

Table 1. ***American Samoa 1999 Estimated Total Bottomfish Landings.***

Species	Pounds
Bigeye Emperor	187
Redgill Emperor	84
Orangespot Emperor	96
Emperors(misc.)	899
Goldenline Bream	34
Flagtail Grouper	20
Blacktip Grouper	115
Peacock Grouper	3
Lunartail Grouper	626
Tomato Grouper	105
Groupers(misc.)	1422
Bluelined Snapper	840
Stone's Snapper	424
Onespot Snapper	29
Yelloweye Opakapaka(P flav)	6
Gindai	124
Gray Jobfish	808
Onaga	1775
Ehu	4156
Yellow Opakapaka (P filam)	683
Humback Snapper	892
Yellowtail Snapper (P aurici)	5
Hawaiian Opakapaka	309
Lehi	666
Bottomhandline Snappers	596
Bottomfish(misc.)	753
Black Jack	1049
Trevally(C caeruleop)	19
Jacks(misc.)	661
TOTAL	**17388**

Interpretation: Changes in species composition of the bottomfish complex reported in the past are due to samplers' varying ability and commitment to the identification of the various bottomfish species. Current data and observations however, do not indicate any major changes in the composition of the bottomfish species landed.
Source: DMWR Offshore Creel Survey

Calculation: Catches are weighed by species either at landing sites or during the selling of fish to dealers. Trips missed by the Creel Survey and sold to local dealers are accounted for in a separate data collections system – the Invoice Purchase System. The above analysis is from the Offshore Creel Survey only. Analysis of the bottomfish fishery presented in this report is for the whole bottomfish complex and **not just for the BMUS.**

Table 2. ***American Samoa 1999 Estimated Commercial Landings by Species.***

Species	Commercial Landings	Price/Lb	Value
Redgill Emperor	84	$2.00	$168
Bigeye Emperor	187	$2.00	$374
Orangespot Emperor	96	$2.00	$192
Emperors (misc.)	889	$1.96	$1743
Tomato Grouper	105	$2.28	$240
Lunartail Grouper	520	$2.06	$1073
Flagtail Grouper	20	$2.70	$54
Blacktip Grouper	115	$2.24	$258
Peacock Grouper	3	$2.00	$6.00
Groupers (misc.)	514	$1.99	$1026
Bluelined Snapper	840	$2.01	$1690
Stone's Snapper	424	$2.00	$847
Yellowtail Snapper	5	$2.00	$10
Onespot Snapper	29	$2.17	$62
Gindai	124	$2.38	$296
Gray Jobfish	808	$2.00	$1617
Onaga	1775	$3.17	$5630
Ehu	3951	$3.17	$12541
Yelloweye Opakapaka	683	$2.65	$1814
Humback Snapper	892	$2.18	$1946
Hawaiian Opakapaka	309	$2.61	$807
Lehi	666	$2.72	$1817
P. auricilia	6	$2.50	$15
Bottomfish (misc.)	753	$2.10	$1588
Black Jack	1021	$2.07	$2115
Trevally (C. caeruleop.)	19	$3.00	$57
Jacks (misc.)	283	$2.22	$628
Others	753	$2.10	$1588
TOTAL	**15122**	**Av. $2.55**	**$38,622**

Interpretation: There appears to be no major changes in the prices of individual species in the past seven years. DMWR keeps track of fish prices for imported fish and those missed by the Offshore Creel Survey through a separate data collection system – the Commercial Invoice System. Data from that data processing system reveals that since 1992, the average price of bottomfish imported from western Samoa were lower than locally caught bottomfish. Locally caught bottomfish are of much superior quality than those imported from Western Samoa (and previously from Tonga) because of better handling and affordable ice. Local fishermen, therefore, expect comparatively higher prices. This was not the case this year as average prices dropped from $2.76 last year to only $2.55 this year (refer to Figure 5).

Source: DMWR Offshore Creel Survey and Commercial Invoice System

Calculation: During creel surveys, the disposition of the catch is recorded, and if sold, the price is obtained whenever possible. The average prices reported in this table are calculated by dividing the total revenue by the weight sold in pounds for each species.

Figure 1. American Samoa Bottomfish Landings in Pounds

Interpretation: The substantial declines in landings in 1987 and 1990 were partially due to vessel losses as a result of 1987, 1990 and the 1991 hurricanes. Boat repairs were delayed as fishermen repaired or rebuilt their homes. In terms of total landings, the bottomfish fishery is much smaller in recent years than it was any time between 1982 and 1986, a period when there was a relatively large fleet and fishermen were attracted to the then profitable bottomfish exports to Hawaii. The increase in 1994 was due primarily to improved sampling on Tutuila and increase efforts by the Tutuila highliners. Furthermore, the Manu'a landings more than tripled due demand for fish for social/cultural events during that year. In 1997, with no additional boats participating and a decrease in bottomfish effort, total landings dropped. Last year's total landings dropped about 50% compared to 1997 as local fishermen concentrated on longlining. This year a couple of boats entered this small fishery and could account for the slight increase in landings.

Source: DMWR Offshore Creel Survey

Calculation: Bottomfish landings for 1982-84 are calculated by adjusting the sampled Tutuila data by the calculated annual percent coverage of the fleet, and then adding the similarly adjusted Manu'a landings. The 1986-present landings are from the creel survey expanded species composition files (*SPC) which contain the annual estimated total landings by species for Tutuila, and then adding the adjusted Manu'a landings. Calculating statistics for 1985 is more complicated, but basically uses both methods, because the sampling program changed from commercial fleet sampling only to creel sampling on October 1, 1985.

Year	Landings(lb.)
1982	64942
1983	126327
1984	94104
1985	143225
1986	96031
1987	31148
1988	71067
1989	47487
1990	14527
1991	18558
1992	13144
1993	17394
1994	44869
1995	35209
1996	38454
1997	39863
1998	15862
1999	17388
Average	**51644**
STD	**39809**

Figure 2. American Samoa Annual Estimated Commercial Bottomfish Landings

Interpretation: Commercial Landings mirror the total fishery's declining catches in recent years. Relative to total landings, commercial landings decreased even more substantially in 1989, because the percent of the catch sold by bottomfish fishermen dropped from an average of about 97% in 1982-1988 to 78% in 1989. The peak in 1983 portrays the high prices of deep-water snappers exported to Hawaii, while the trough in 1987 can be attributed to effects of the 1987 hurricane. The December 1991 hurricane contributed largely to the decreased landings and subsequently a decrease in revenues in 1992. Unfavorable weather continued through May 1992 hindering commercial bottomfish fishing. Increased efforts in 1994 produced a notable increase in revenues. The general decline of commercial landings since 1996 mirrors total bottomfish landings. This trend reflects the continued shift of participation away from bottomfish (from trolling to longlining since 1995) and does not portray problems with the resource. After the significant decline in commercial landings and revenues in 1987-1998, a small increase was recorded this year with contributions from a few boats entering this fishery.

Source: DMWR Offshore Creel Survey

Calculation: A relative complex set of algorithms is used to estimate the commercial landings from estimates of total landings created by the creel survey data expansion system. In short, the percent sold by the bottomfish method is calculated monthly and multiplied by the percent species composition by month, then multiplied by the estimated total landings for the bottomfish method and month. For 1982-1985 sampling was conducted on the commercial fleet only (which included nearly all the fishing boats) whereas since 1985 creel sampling has covered all boats (commercial, subsistence and recreational). Analysis of creel data for 1986-1987 indicates that over 98% of the landed bottomfish were sold. Therefore, it is believed to be valid to compare commercial data for years prior to 1986 to creel survey totals for years since 1986.

Years	Commercial Landings	Revenues	Inflation Adjusted Revenues
1982	62016	113678	181771
1983	125167	269083	427035
1984	92841	166917	259890
1985	102670	141495	218185
1986	95291	142703	213056
1987	30655	46502	66545
1988	67641	113018	156755
1989	36168	55732	74124
1990	12731	21078	26010
1991	17629	31817	37607
1992	13092	26379	29940
1993	15431	27930	31673
1994	41316	85115	94648
1995	34751	64864	70572
1996	37843	72686	76248
1997	38339	82126	84015
1998	14400	39758	40156
1999	15122	38623	38623
Average	**47395**	**85528**	**118158**
STD	**35380**	**63907**	**106560**

Figure 3. American Samoa Annual Estimated Bottomfish Hours and Trips

Interpretation: The sharp decline in the bottomfish landings since 1986, noted in Fig.1 is mirrored in this figure by a sharp decline in the level of effort expended in this fishery. Rather than indicating a problem with the resource, this decline depicts an actual trend of commercial boat owners and fishermen seeking other more lucrative and stable jobs. The noticeable increase in effort in 1997 is primarily due to improved sampling, increased effort by the Tutuila highliners and the significant (about tripled) increase in effort by the Manu'a fleet. The bottomfish highliners diverted part of their fishing effort for longlining in 1994 and contributed to the decrease in bottomfish trips and effort. The 1994-1996 estimated efforts were greater than those for the 1990-1993 period due to the highliners increased effort, with some boat owners employing teams (usually 2-3 fishermen) in continuous shifts during good weather. In 1998, the number of boats participating in this fishery dropped significantly (refer to Figure 4) resulting in the notable declines in number of trips and hours fished last year. A couple of new boats, bought from western Samoa entered this fishery this year and a few alias rigged for longline also made several bottomfish trips, contributing to the slight increase in effort.

Source: DMWR Offshore Creel database

Calculation: The annual estimated effort (hours) spent bottomfishing is calculated by dividing the annual estimated total bottomfish catch by the average CPUE (pounds per hour) from trips doing only bottomfish fishing, The annual estimated number of trips is calculated by dividing the estimated annual hours by the average length of a bottomfish fishing trip. The average length of a bottomfishing trip (not shown) is calculated by using only trips which exclusively bottomfished and for which the trip length was recorded. The total hours fished from those trips is then divided by the number of trips. Recorded hours are trip hours.

Year	Hours	Trips
1982	7671	548
1983	12695	621
1984	8796	468
1985	17682	1116
1986	10969	698
1987	2654	222
1988	3102	296
1989	2844	313
1990	1567	124
1991	2029	144
1992	1408	99
1993	2376	140
1994	5842	340
1995	3587	275
1996	2603	264
1997	2712	290
1998	1132	100
1999	1350	122
Average	**5057**	**343**
STD	**4686**	**264**

Figure 4. American Samoa Annual Estimated Number of Boats Landing Bottomfish.

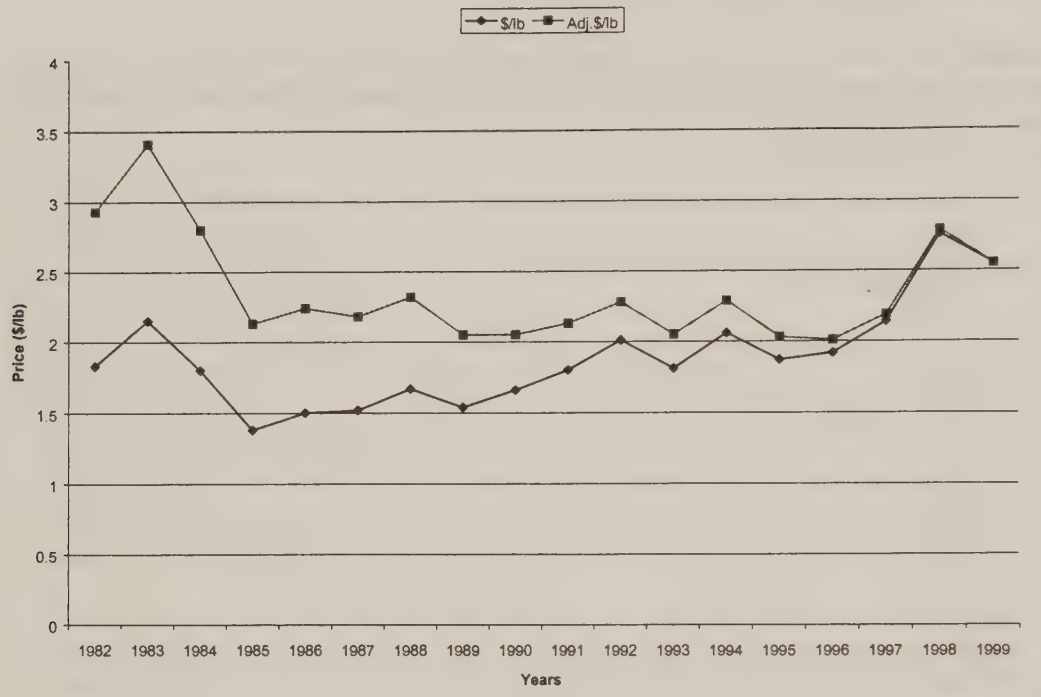
Interpretation: Again, the decline in the fishery since 1985-86 is reflected by a decline in the number of boats participating in it. The 1987 hurricane caused the loss of the whole Manu'a fleet, plus some of the Tutuila fleet. Several Boats that contributed to the 1989 bottomfish annual landings did not land any bottomfish in 1990, due to much needed boat repairs and their participation in non-fishery trips. About 90% of the domestic fishing fleet was affected by the December 1991 hurricane, hence the slight decline in 1992. The increase in 1993 is due mainly to the re-entry to this fishery of a few boats after repairs, trips by two 14-foot vessels that didn't bottomfish in 1992, and the entry of one new alia into the sampling area. A few new alias were bought from western Samoa and entered the fishery in 1995-1996. The continued increase in the number of boats electing to longline, attracted by the relatively higher revenues obtained mainly from the albacore sold to the canneries, is reflected in the significant drop in the number of boats bottomfishing last year. A couple of new boats entered the fishery this year.

Source: DMWR Offshore Creel Survey database

Calculation: The annual estimate of the number of boats in the bottomfish fishery is obtained from the database by counting the unique boats sampled during the year which landed any bottomfish species.

Years	Nos. Boats
1982	27
1983	38
1984	48
1985	47
1986	34
1987	20
1988	26
1989	29
1990	19
1991	20
1992	14
1993	22
1994	19
1995	25
1996	26
1997	24
1998	16
1999	19
Average	**26**
STD	**10**

Figure 5. American Samoa Average Price of Bottomfish



Interpretation: Inflation-adjusted prices were generally higher between 1982 and 1984 during the exportation of high-priced deepwater snappers to Hawaii. After this period, inflation-adjusted local prices have generally been stable. Prices of locally caught bottomfish are generally higher than imported fish, and could have been even higher had the local markets not been impacted by imported fish, which are usually of lower quality. Imported bottomfish (mainly from western Samoa) have always helped in meeting the demand for bottomfish. The increase in average price in 1998 is attributed mainly to the increase in demand for fresh bottomfish by a few new restaurants. This year there was a 22% increase in pounds (and a 15% increase in revenue) of miscellaneous bottomfish imported from Western Samoa and may contribute (increase supply) to this years price drop.

Source: DMWR Offshore Creel Survey database

Calculation: The average price of all bottomfish species combined is calculated by dividing total bottomfish revenue by total sold weight. The inflation-adjusted price is calculated by multiplying the unadjusted annual average price by the annual calculated consumer price index (CPI) for American Samoa using the current year as base.

Year	Prices ($/lb.)	Inflation Adjusted $/lb.
1982	1.83	2.93
1983	2.15	3.41
1984	1.80	2.80
1985	1.38	2.13
1986	1.50	2.24
1987	1.52	2.18
1988	1.67	2.32
1989	1.54	2.05
1990	1.66	2.05
1991	1.80	2.13
1992	2.01	2.28
1993	1.81	2.05
1994	2.06	2.29
1995	1.87	2.03
1996	1.92	2.01
1997	2.14	2.19
1998	2.76	2.79
1999	2.55	2.55
Average	**1.89**	**2.36**
STD	**0.36**	**0.39**

Figure 6. American Samoa Annual Bottomfish CPUE

Interpretation: The initial high CPUE in 1983 and 1984 occurred during the intense fishing of some new fishing grounds for deepwater snappers for export to Hawaii. A relatively high number of boats and local fishermen participated in the fishery during this period. The decline in 1985 and 1986 might be expected following the ardent harvesting of the limited fishing grounds. Reasons for the CPUE peak in 1988-89 are unknown. The decline in CPUE from 1989 to 1991 can be partially attributed to a combination of some new inexperienced fishermen entering the fishery and the exit of experienced and full-time commercial fishermen. CPUE has essentially remained stable during 1990-1992, and has increased since then. Bottomfishing techniques and gear have generally remained the same in the past years with the Alias being the highliners since the early 1970's. The 1995-96 high CPUE estimates (and most probably the 1988-89 CPUE increase) can be attributed mainly to improved sampling. All CPUEs since 1997 was higher than the estimated virgin CPUE and the past two year's CPUE was not less than 50% of the average aggregate CPUE for the first three years of available data, indicating no immediate cause for concern.

Source: DMWR Offshore Creel Survey database

Calculation: CPUE is calculated using only trips in which only the bottomfish method was used and trip hours were recorded. The average is calculated by using each CPUE from each trip as an observation and dividing by the number of trips.

Year	CPUE
1982	8.5
1983	10.0
1984	10.7
1985	8.1
1986	8.8
1987	11.7
1988	17.3
1989	16.7
1990	9.3
1991	9.1
1992	9.3
1993	7.3
1994	7.7
1995	9.8
1996	14.8
1997	14.7
1998	14.0
1999	12.9
Average	**11.15**
STD	**3.06**

Figure 7. American Samoa Average Inflation-Adjusted Revenue Per Trip Landing Bottomfish.

Interpretation: There have been no notable changes in revenue since 1990. The distance between these two lines reflects the relative importance of bottomfish species in the total catch whenever any bottomfish are landed. The prominent importance of bottomfish between 1982 and 1985 occurred during the targeting of deepwater snappers (mainly ***Etelis*** and ***Prisitipomoides***) for export to Hawaii. Bottomfish fishing was also the more profitable method of fishing during that period. The relative importance of bottomfish has generally been declining since 1985 as many of the full-time commercial fishermen quit the fishing business with others remaining opting for trolling. The supply of locally caught bottomfish has been supplemented by bottomfish imported from western Samoa. Gradual increasing inflation-adjusted prices of bottomfish in the past three years (refer to Figure 5)contrast the declining trend in the revenue data below and mirrors the declining importance of the bottomfish fishery. A slight increase in bottomfish revenues this year, however, is indicated in the table below.

Source: DMWR Offshore Creel Survey database

Calculation: The average revenue per trip for all species is calculated by summing the revenues of all sales for any trip which landed any bottomfish species, and dividing by the number of trips. The average bottomfish revenue per trip is calculated from those same trips by summing the sales of only bottomfish species and dividing by the number of trips. Figure 7 plots the inflation-adjusted bottomfish and all species revenue per trip for the period 1982-1999.

Year	Bottomfish $/trip Unadjusted	Bottomfish $/trip Adjusted	All Species $/trip Unadjusted	All Species $/trip Adjusted
1982	185	295	196	313
1983	341	541	388	616
1984	269	418	309	481
1985	151	233	157	242
1986	189	282	228	340
1987	184	263	248	354
1988	269	373	371	515
1989	163	217	327	435
1990	160	198	205	253
1991	163	192	243	287
1992	191	217	307	348
1993	156	177	237	268
1994	181	201	250	278
1995	235	256	299	326
1996	226	237	289	303
1997	197	201	282	289
1998	189	191	379	383
1999	197	197	305	305
Average	**203**	**261**	**279**	**352**
STD	**49**	**95**	**64**	**100**

Appendix 2

Guam

CONTENTS

1. Introduction 2-2

2. Summary 2-3

3. Historical Annual Statistics 2-4

4. Recommendations 2-5

5. List of Tables 2-7

6. List of Figures 2-7

Introduction

Guam has two distinct bottomfish fisheries which can be separated by depth and species. The shallow-water complex (<500 feet) makes up a larger portion of the total bottomfish harvest and is comprised of an assemblage of reef-dwelling snappers, groupers and jacks of the genera *Lutjanus, Lethrinus, Aprion, Epinephelus, Variola, Cephalopholis* and *Caranx.* The deep-water complex (>500 feet) consists primarily of snappers and groupers of the genera *Pristipomoides, Etelis, Aphareus, Epinephelus,* and *Cephalopholis.*

Bottomfishing on Guam is a combination small-scale commercial and subsistence fishery. This fishery is also highly seasonal in that most bottomfishing effort occurs during the summer months when sea conditions are generally much calmer. The majority of the participants are part-time recreational and subsistence fishermen who operate vessels less than 25 feet in length, primarily target the shallow-water bottomfish complex, combine some trolling effort to supplement bottomfishing effort, and seldom sell their catch commercially.

Historically, notable fluctuations in Guam's annual BMUS harvests have been caused by the respective entry and exit of highliner vessels. These highliner vessels tend to be greater than 25 feet in length and their effort is usually concentrated on the deep-water complex.

Adding to Guam's bottomfishing effort in recent years is the charter fishing component which now includes boats making multiple two to four-hour bottomfishing trips daily. The types of vessels making such trips range from the more typical trolling charter boat involving 3-6 patrons who opt to bottomfish instead, to the larger bottomfishing-only "head-boat" vessels accommodating as many as 30 patrons per trip. The larger bottomfishing vessels generally fish in the same area and release most of their catch.

Centrally located on the western leeward coast, the Agana Boat Basin serves as the island's primary small-boat launch site to fishing areas off the central and northern leeward coast, as well as the northern banks. Situated to the south, the Merizo Pier, Umatac Boat Ramp and Agat Marina serve as access points to the southern shores and banks. The Agat Marina in particular, located between the Agana Boat Basin and the Merizo Pier, provides boats trailered from the northern and central portions of the island a closer and more convenient launch site to the southern fishing grounds. A makeshift ramp on the east side of the island, Ylig Bay, provides access to bottomfishing areas, although fishing only occurs during the calm summer months.

The demand for both deep- and shallow-water bottomfish continues to exceed the locally-caught supply. Although Guam's deep-water bottomfish fishery has limited economic importance, especially during the absence of highliner vessels, the cultural value of its shallow-water complex remains high due to the popularity of this assemblage of fish as food items. Some of the demand for both complexes of bottomfish is offset with imports from other islands throughout Micronesia.

Summary

The Guam offshore creel survey expansion system now utilizes a database format, rather than the spreadsheet format used in previous years, to expand the survey data. This improvement, combined with the implementation of offshore creel surveys at the Merizo Pier in 1991 and the Agat Marina in 1994, and recent revisions of expansion algorithms, have contributed to the increased efficiency in the production and reliability of the Guam annual reports. Although complemental statistics of confidence and analysis of biological and species composition data are not possible at this time, DAWR is continuing work with the WPacFIN program coordinator to further develop the expansion system to eventually include production of such analyses. The expansion program will ultimately also have the capability of integrating the offshore survey data with the inshore survey data in order to obtain a better idea of BMUS being caught by both offshore and inshore methods.

Previous analysis of the bottomfish fishery data indicated that Guam's aggregate CPUE per boat trip for all bottomfishing methods, including deep- and shallow-water complexes in both territorial and federal waters, may have been in a "yellow light" condition, and indicator of fishery stress. The new expansion program shows that a "yellow light" condition is not occuring, although CPUE across all strata is declining. According to local fishermen and creel census, however, the bottomfish fishery is stressed. The sizes of commonly caught bottomfish are decreasing, especially those of the shallow complex, but are many times still taken. In 2000, Guam will be enforcing marine preserves that were established, hopefully to reduce stress on fish stocks impacted by a host of fishing methods, including bottomfishing.

Historical Annual Statistics

Year	Total bottomfish landings (lbs)	CPUE (lbs/trip hr)	CPI	Adjusted revenues ($)	Adjusted price/lb ($)	Number of boats
80			134.00	41,559	4.43	
81			161.40	55,974	5.35	
82			169.70	36,525	5.52	
83			175.60	181,422	5.00	
84			190.90	102,289	5.09	
85	137,192	5.7	198.30	126,904	4.69	63
86	59,102	5.2	203.70	50,794	4.42	39
87	58,931	5.8	212.70	53,815	4.26	96
88	101,414	4.9	223.80	64,222	4.07	107
89	145,671	5.6	248.20	92,082	4.74	110
90	86,244	4.5	283.50	83,957	4.57	116
91	105,261	4.8	312.50	47,013	4.36	173
92	96,931	5.8	344.20	41,527	4.01	173
93	126,707	4.2	372.90	38,241	3.78	271
94	113,761	5.6	436.00	116,882	3.87	268
95	158,620	2.5	459.20	46,476	3.48	422
96	251,825	4.1	482.00	17,632	2.68	400
97	135,195	3.7	482.50	28,266	3.01	354
98	127,876	2.5	485.30	43,009	3.31	367
99	**267,503**	**3.2**	**486.00**	**108,165**	**3.61**	**367**
Average	131,482	4.5	303.12	68,838	4.21	222
Std. dev.	59,553	1.2	128.46	40,981	0.76	134

Recommendations

Status of 1998 recommendations:

Recommendation 1:

The new expansion algorithms show that Guam's bottomfish fishery rebounded a "yellow light" condition in 1998. The non-charter boat bottomfishing CPUE does not fall within the "yellow light" condition. However, the data from the new expansion process can only be considered preliminary. The new offshore expansion program should be nearly completed, and a more accurate picture of Guam's bottomfish fishery should be available.

Recommendation 2:

Currently, verification of the offshore fishery data from 1985 to the present is nearly complete. Data from 1980 to 1984 will be inputted and verified by DAWR staff, then the whole time series reprocessed in order to provide a consistent time line in this module . Problems with historical data do exist, especially in interpreting for various strata that is currently being collected, but progress made with the 1985 data can be applied to earlier years.

Recommendation 3:

The biologist leading the baseline biological survey of the red-gill emperor has left Guam's Fisheries staff. A new DAWR staff should being assigned to complete the red-gill emperor research project, by possibly next year.

Recommendation 4:

DAWR and NMFS staff will continue to work towards establishing mean fish size, percent immature, and SPR indicators for Guam's deep and shallow bottomfishing complexes. Guam's offshore creel census collects size information to the species level from bottomfishing activity, both shallow and deep, encountered during creel surveys, and progress is being made to be able to expand for both the shallow and deep complexes

1999 Recommendations:

1)The data presented should only be considered preliminary, although great strides have been made to verify the historical data and create a program able to expand the offshore data in a consistent manner although offshore creel surveys have changed over the years. Efforts should continue to develop and fine-tune the database computer program that will provide DAWR with the capability of integrating the offshore survey expansion data with the inshore expansion data, and additionally produce statistics of confidence, a compilation of biological data, and a complete species composition analysis according to Plan Team requirements. Upon completion of the computer program, designated DAWR staff should be trained to use the new software to reprocess creel survey data from 1980 to present. Training should also be provided to teach staff how to interface with NMFS/WPacFIN software. Such training would facilitate additional support from NMFS/WPacFIN in the processing and analysis of fisheries data if necessary.

2) The need to complete the baseline biological survey of the red-gill emperor, *Lethrinus rubrioperculatus*, remains as the single most important data deficiency for the Marianas shallow-water bottomfish resource. DAWR should assigned another biologist to this project, and attempt to complete this project as soon as possible.

3) With additional funding from the WPacFIN program and technical assistance from the NMFS, DAWR should establish mean fish size, percent immature and SPR indicators for Guam's deep- and shallow-water bottomfish complexes.

Tables

page

1. Guam 1999 expanded creel survey composition of allocated bottomfish management unit species (BMUS) 2-8

2. Guam 1999 commercial bottomfish average price 2-9

Figures

page

1. Guam harvest of BMUS and all bottomfish 2-10

2a. Total and commercial BMUS harvest 2-13

2b. Total and commercial BMUS revenue 2-14

3. Estimated boat hours and trips 2-17

4. Guam bottomfish fishery participation 2-20

5. Average bottomfish prices 2-22

6. Guam bottomfish CPUE 2-24

7. Guam average revenue per trip 2-26

Table 1. Guam 1999 expanded creel survey composition of bottomfish management unit species (BMUS)

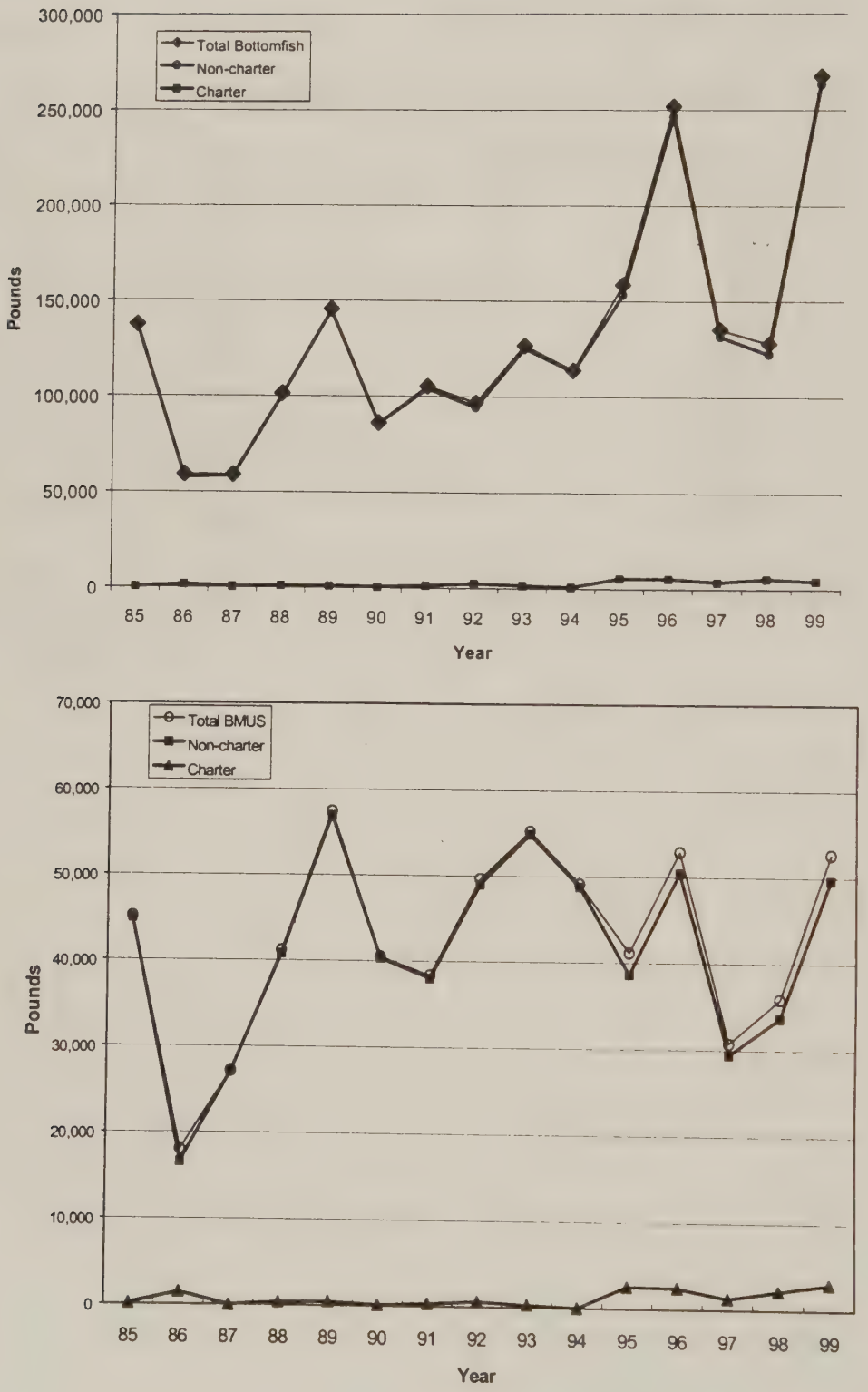
Species	Bottomfishing method only (lbs)
Lehi (*A. rutilans*)	1,882
Uku (*A. virescens*)	2,347
Jacks (*C. ignobilis, C. lugubris*)	2,297
Groupers (*C. urodeta, E. fasciatus, V. louti*)	6,742
Ehu (*E. carbunculus*)	668
Onaga (*E. coruscans*)	15,491
Emperors (*L. amboinensis, L. rubrioperculatus*)	7,752
Taape (*L. kasmira*)	3,600
Kalekale (*P. seiboldi*)	1,098*
Yellowtail Kalekale (*P. auricilla*)	4,043
Pink Opakapaka (*P. filamentosus*)	865*
Yelloweye Opakapaka (*P. flavipinnis*)	760
Gindai (*P. zonatus, P. argyrogrammicus***)	2,557
Amberjack (*S. dumerili*)	2,560
Total	**52,662**

*from commercial landings higher than creel census
**non-BMUS species

Table 2. Guam 1999 commercial bottomfish average price

Species	Average $/lb
Miscellaneous Bottomfish	3.06
Grouper	2.54
Jacks	2.52
Lehi	3.97
Uku	2.71
Ehu	3.98
Onaga	4.09
Opakapaka	3.98
Kalikali	3.52
Gindai	4.00
Emperor	2.95
Amberjack	2.57
All Bottomfish Species	**3.61**

Figure 1. Guam harvest of BMUS and all bottomfish



Interpretations: Annual fluctuations in BMUS landings on Guam are usually due to highliner fishermen entering or leaving the fishery during a given year. For example, the 1985 peak followed by the apparent crash in 1986 of BMUS harvests were the result of a few highliner fishermen who fished in 1985 and then left the fishery the following year. The increase in bottomfish catch may have been due to an increase in participation and effort in this fishery during 1999.

The decrease in the "all bottomfish" category observed in 1997 may have been caused by the elimination of the bigeye scad, *Selar crumenopthalmus*, as part of the bottomfish catch in the 1997 expansion. The inclusion of this fish in previous bottomfish expansions, especially during a bumper harvest year such as 1996, likely had the effect of inflating bottomfish catch totals. This occurs when fishermen respond that these catches were obtained by "bottomfishing" rather than the traditional night-light jigging. Currently, DAWR staff have been trained to obtain the correct method used to catch bigeye scad. However, it is not unusual for bigeye scad to be caught bottomfishing.

The increase in the BMUS harvest in 1999 is due to the few number of fishermen concentrating on the deep-water bottomfish fishery that particular year. The significant increase in onaga landings was due to a highliner concentrating on this particular fishery during 1999.

Source: The DAWR offshore creel survey data as expanded by computer-based algorithms by method of fishing. All unidentified catch was allocated to species categories based on the species percentage of the total catch.

Calculations: The estimated total landings of the bottomfish species are selected from the expanded creel survey species composition files. However, the expanded estimates of catch by species must include at least a portion of the catch identified only by generic species codes categories. These generic categories (e.g. "mixed shallow bottomfish") also include some non-BMUS bottomfish according to the FMP definition (e.g. squirrelfish).

Year	Harvest (lbs) All Bottomfish	Non-charter	Charter
85	137,192	137,004	188
86	59,102	57,627	1,475
87	58,931	58,473	458
88	101,414	100,482	931
89	145,671	144,823	848
90	86,244	85,860	384
91	105,261	104,015	1,246
92	96,931	94,478	2,453
93	126,707	125,215	1,492
94	113,761	113,005	756
95	158,620	153,168	5,451
96	251,825	246,424	5,402
97	135,195	131,596	3,599
98	127,876	122,434	5,442
99	**267,503**	**263,169**	**4,334**
Average	131,482	129,185	2,297
Std. deviation	59,553	58,289	1,993

Year	Harvest (lbs) BMUS	Harvest (lbs) Non-charter
85	45,066	44,923
86	18,035	16,593
87	27,134	27,134
88	41,148	40,776
89	57,426	56,975
90	40,457	40,309
91	38,347	38,003
92	49,647	49,004
93	55,205	54,885
94	49,124	48,821
95	41,156	38,610
96	52,926	50,456
97	30,744	29,424
98	35,866	33,667
99	**52,662**	**49,661**
Average	42,330	41,283
Std. deviation	11,146	11,157

Figure 2a. Total and commercial BMUS harvest

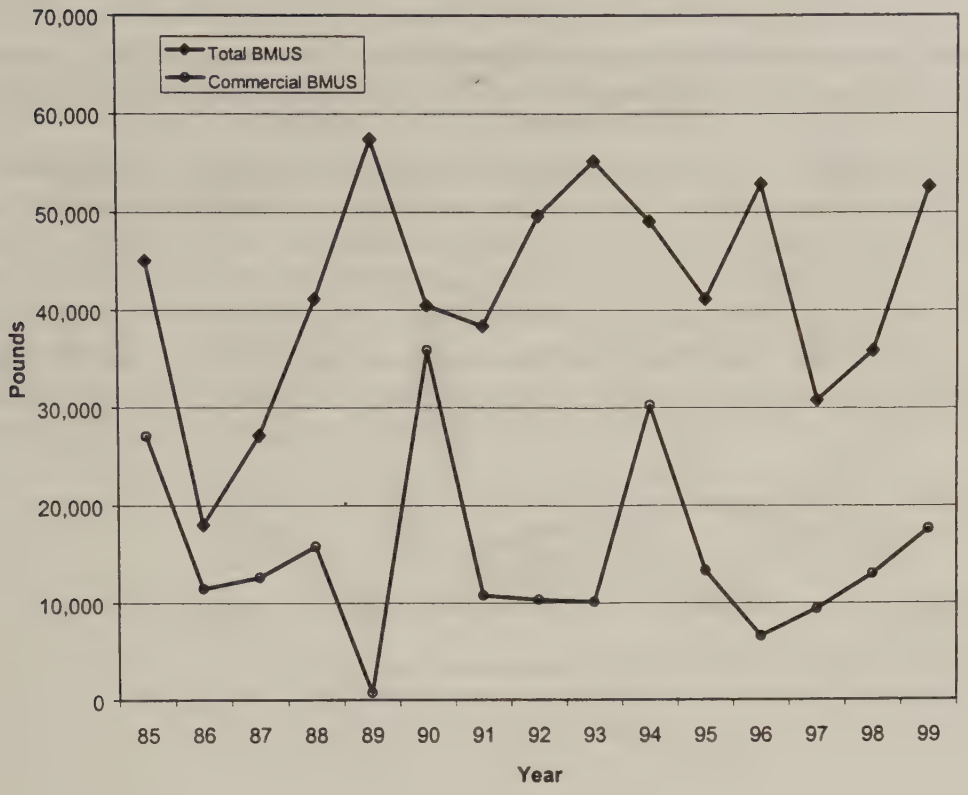
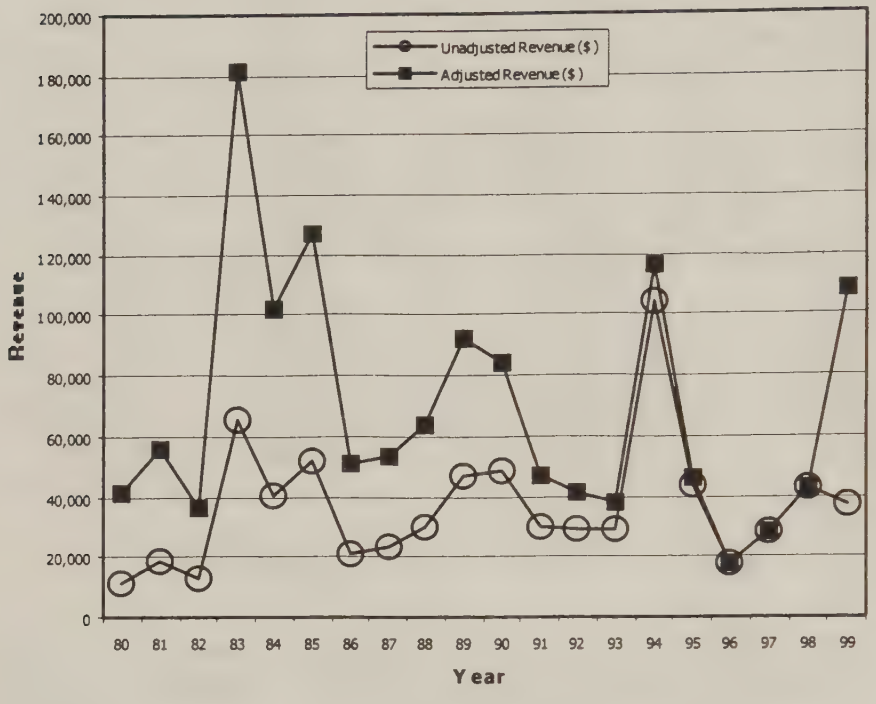


Figure 2b. Total and commercial BMUS revenue



Interpretations: Guam's highliner fishermen have generally been responsible for the peaks in commercial BMUs landings, as was the case in 1983, 1985, 1994, 1998, and 1999. For example, the nearly 300% increase in 1994 of the commercial BMUS harvest and revenue over the previous year's figure, is the result of highliner vessels entering (or reentering) into the fishery during that year. The 39% reduction in BMUS harvest and 56% decline in commercial harvest for 1995 are best explained by the absence or reduced effort of about six highliners who combined, have landed an average of 18% of the total BMUS harvests between 1992 and 1996, and 68% of the unexpanded commercial landings for the same period. Harvest records for these six highliners indicate a 45% reduction in 1995 of their total bottomfish harvest, dropping from 13,349 pounds in 1994, down to 6,023 pounds in 1995. This decline in highliner landings accounts for about two-thirds of the 1995 reduction in commercial BMUS harvest.

The 1996 peak and 1997 46% decline in total BMUS harvest is believed to have been influenced more by weather conditions than any other factor: there were more calm water days in 1996 than in 1997. This was also observed in 1999.

In 1996, commercial BMUS harvest and adjusted revenue dropped to its lowest point ever, owing in large part to the almost complete absence of highliner activity in the fishery. The slight increase in 1997 is attributed to one highliner fisherman who made several recorded trips to the rarely-fished "Bank A" located approximately 117 miles west of Guam. The

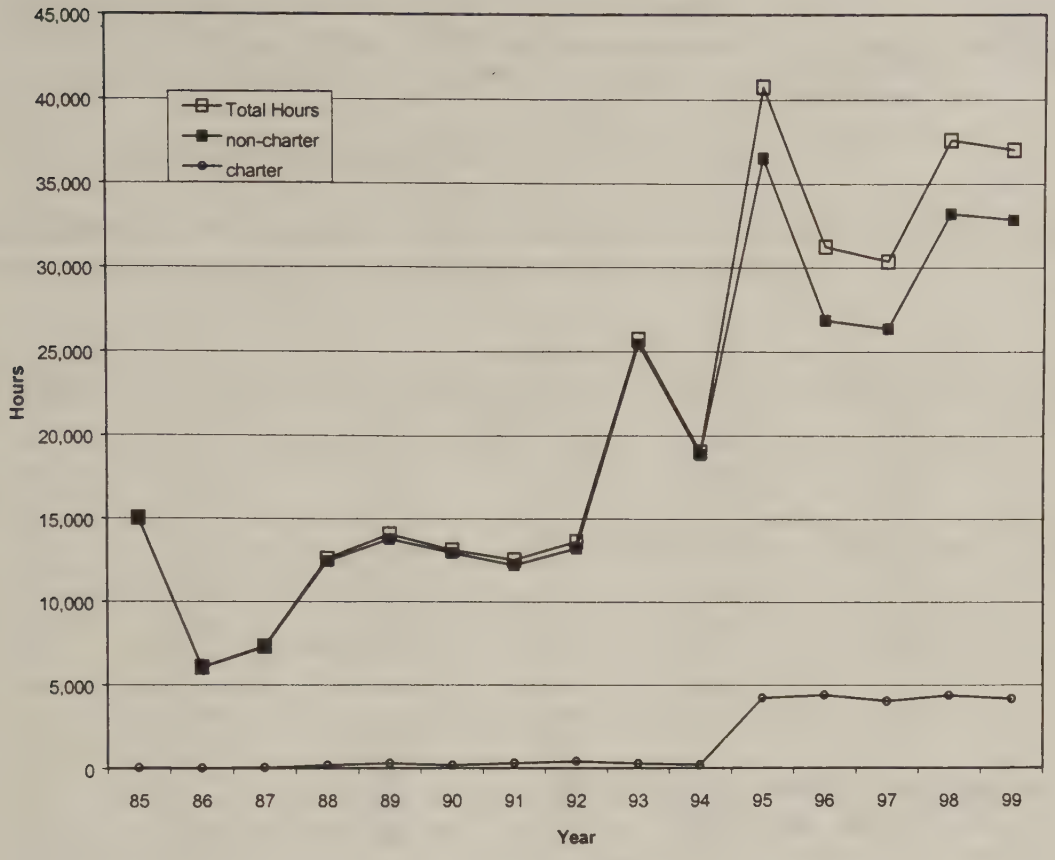
increase in 1999 is likely the result of several highliners as well as an overall increase in participation and effort.

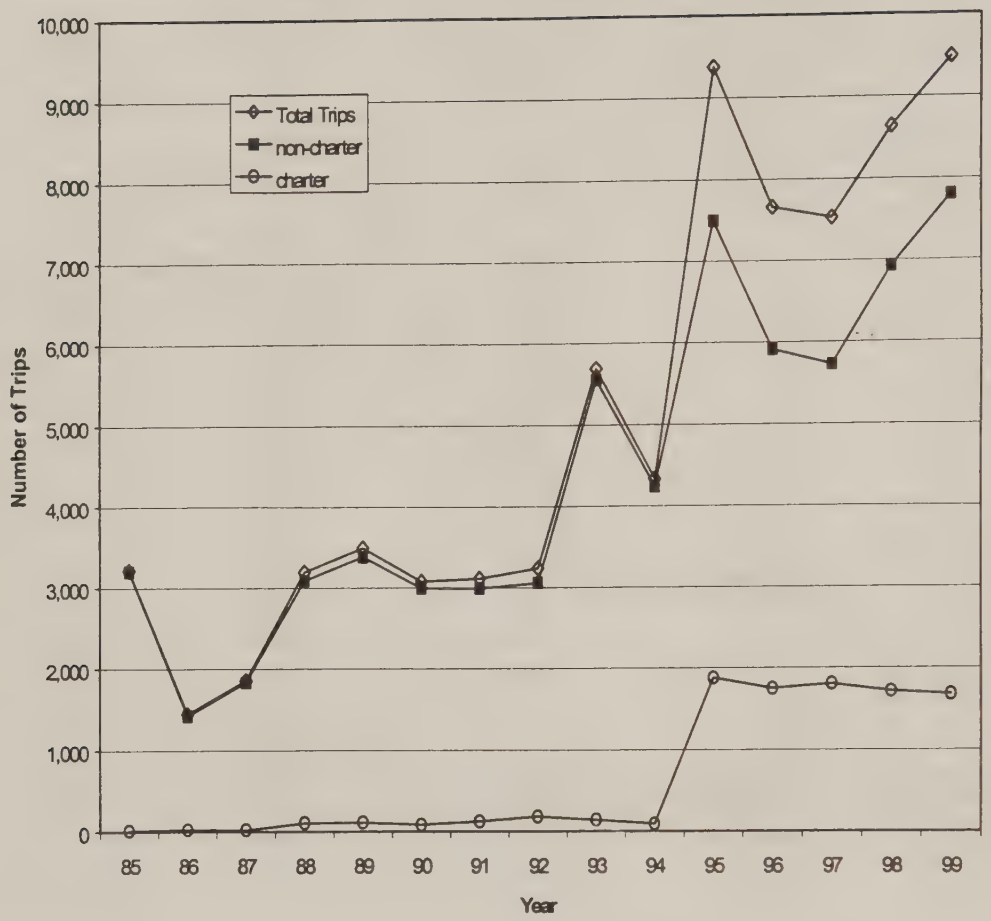
Source: The estimated total landings are from the DAWR creel survey system, and the commercial data are from the WPacFIN-originated commercial landings system.

Calculations: The total commercial bottomfish landings and revenue for each year were calculated by summing the weight and value fields in the commercial landings data base and then multiplying by an estimated percent coverage expansion factor. This annual expansion factor was subjectively created and includes an analysis of the "disposition of catch" data available from the DAWR offshore creel survey, an evaluation of the fishermen in the fishery and their entry and exit patterns, general dock-side knowledge of the fishery, status of marketing conditions and its structure, overall number of records in the data base, and a measure of the best-educated guess.

Year	Total BMUS Harvest (lbs)	Commercial BMUS Harvest (lbs)	Unadjusted Revenue ($)	Adjusted Revenue ($)
80	19253	9381	11458	41502
81	42517	10459	18590	55900
82	43428	6617	12753	36474
83	39193	36281	65543	181160
84	32232	20115	40176	102128
85	68141	27064	51777	126697
86	17969	11482	21289	50709
87	24288	12639	23551	53744
88	33724	15792	29568	64104
89	39814	19442	47029	91941
90	31295	18390	48983	83859
91	29962	10773	30234	46953
92	34057	10344	29410	41469
93	48494	10125	29348	38182
94	49169	30237	104827	116673
95	40924	13339	43929	46433
96	53572	6578	17492	17615
97	29243	9387	28070	28238
98	**44097**	**13011**	**42966**	**42966**
99	**52,022**	**17,621**	**108,165**	**108,165**
Average	38670	15454	40258	68746
Std. deviation	12286	7961	26664	40923

Figure 3. Estimated boat hours and trips





Interpretations: The almost three-fold increases in 1995 are largely the result of the nearly 60% increase in the number of boats, primarily recreational and subsistence, entering into the fishery that year, and a higher number of calm days throughout the year which enabled many of them to bottomfish more often than usual. The increase in boat trips and hours may have also been due to the establishment of the Agat Marina survey in 1994 which served to improve the estimation of the number of recreational/subsistence and charter boats bottomfishing out of this port, and the opening of boat slips at the marina that same year which enabled bottomfish charter boats to operate regularly out of this port. Interestingly, the charter boat component of the bottomfish fishery in 1996 accounted for 23% of the total number of bottomfishing trips, and 13% of the hours fished. Furthermore, the Agat Marina creel survey almost always includes several charter bottomfishing vessels making multiple trips on each survey day. A leveling off of charter trips may be due to the decrease in the number of tourists seeking this type of experience due to cost. The rash of typhoons the hit Guam between 1996 and 1997 may explain the slight declines in bottomfishing trips and hours during those years. A return to more normal weather patterns in 1999 best explains the increases last year.

The extended periods of unusually calm seas throughout 1993 resulted in more boats bottomfishing more often and for longer periods, which best accounts for the spike in boat

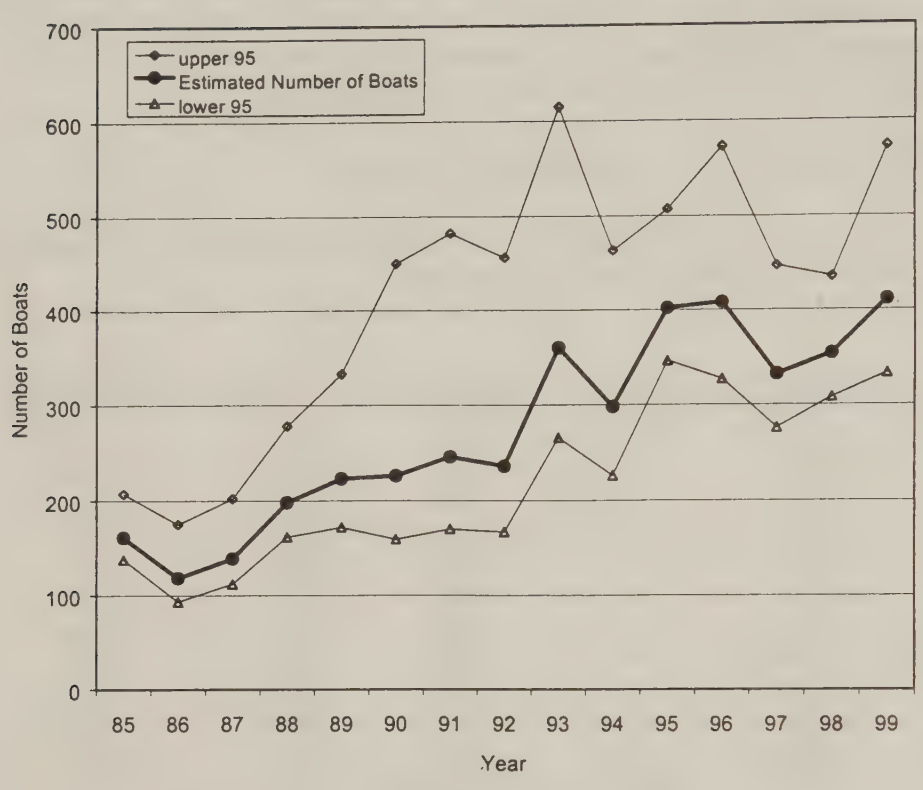
hours and trips recorded for that year. The apparent 1994 declines represent a return to normal weather and fishing conditions, but are still indicative of an increasing trend in the total number of boat trips and boat hours since 1986. The succession of typhoons and inclement weather that hit Guam between 1990 and 1992 may have suppressed the expected trend of a steady increase in the number of boat trips and boat hours during that period.

Source: The DAWR creel survey data for bottomfishing methods.

Calculations: The estimated number of boat trips and boat hours for bottomfishing methods are derived directly from the creel survey expansion algorithms.

Year	Total Hours	non-charter	charter	Total Trip	non-charter	Charter
85	15,037	14,989	48	3,212	3,201	11
86	6,058	6,033	24	1,444	1,422	23
87	7,313	7,264	48	1,857	1,835	22
88	12,611	12,435	176	3,190	3,085	105
89	14,077	13,782	295	3,493	3,379	114
90	13,128	12,952	177	3,071	2,988	83
91	12,527	12,217	310	3,109	2,986	123
92	13,636	13,225	411	3,234	3,054	180
93	25,721	25,446	275	5,689	5,549	141
94	19,038	18,849	188	4,331	4,238	93
95	40,767	36,541	4,226	9,376	7,498	1,878
96	31,249	26,863	4,386	7,657	5,912	1,745
97	30,370	26,360	4,010	7,527	5,724	1,803
98	37,603	33,227	4,376	8,636	6,924	1,712
99	**37,019**	**32,860**	**4,159**	**9,479**	**7,804**	**1,675**
Average	21,077	19,536	1,541	5,020	4,373	647
Std. deviation	11,632	9,869	1,974	2,784	2,042	819

Figure 4. Guam bottomfish fishery participation



Interpretations: Over the last several years the number of boats participating in this fishery leveled off, but may be increasing due to better weather conditions. The approximately 57% increase between 1992 and 1994 is believed to be the result of an improvement in the sampling effort with the inclusion of the Merizo Pier as a survey site in 1991, and a healthy economy that made it possible for more residents to afford boats. Another 57% increase occurred in 1995 over the previous year due to another improvement in sampling effort with the inclusion of the Agat Marina as an offshore creel survey site in October, 1994. In general, most of the newcomers in the last five years are recreational and subsistence-type vessels who bottomfish only part-time and primarily target the shallow-water bottomfish complex.

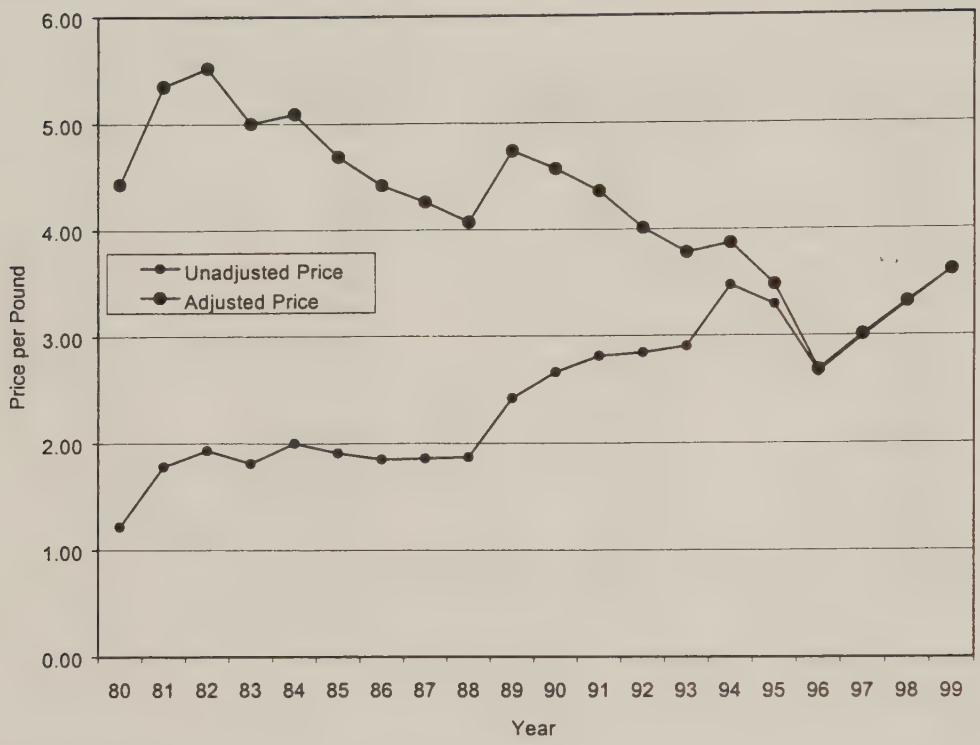
Source: DAWR offshore creel survey boat log data from Agana Boat Basin, Agat Marina and Merizo Pier boat launch sites. The data was converted and processed using the WPacFIN-generated boat estimator model.

Calculations: The 1998 figure was obtained by first running the above-mentioned model 1,000 times using a randomly selected order of the days sampled at all three ports combined, then eliminating the upper and lower 25 estimates to rid the model of occasional outlier estimates; and finally calculating the mean and standard deviation for the remaining 950 estimates. The removal the outliers conducted in the second step lowered the original estimated number of boats after the model was run 1,000 times by about 1%, but more

importantly, reduced the standard deviation by approximately 20%. Previous year's estimates were calculated using a similar conservative threshold C/E model which was run a minimum of 15 times per year.

Year	Lower95	Number of Boats	Upper95
85	138	161	207
86	93	118	175
87	112	139	202
88	162	198	278
89	172	223	333
90	159	226	450
91	170	246	482
92	167	236	456
93	266	360	615
94	226	298	463
95	346	402	507
96	327	408	573
97	276	332	447
98	308	354	435
99	**333**	**411**	**573**
Average	217	274	413
Std. deviation	85	100	142

Figure 5. Average bottomfish prices



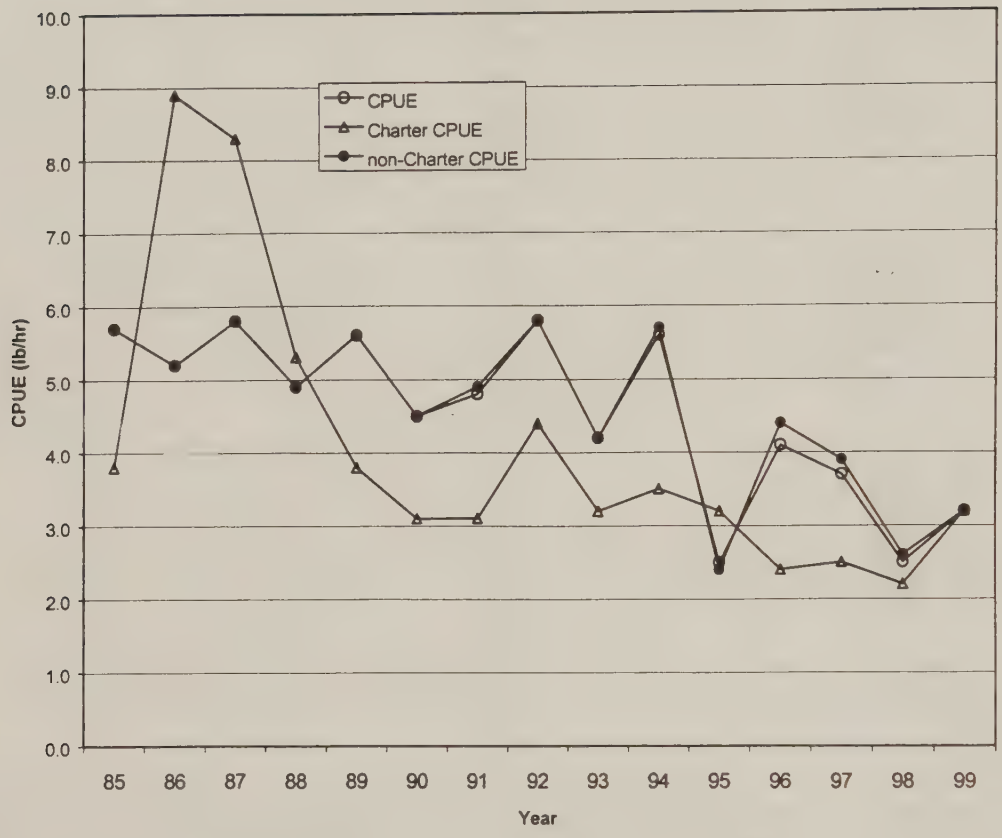
Interpretations: The adjusted average price for bottomfish has increased only slightly in the last couple of years and is likely the result of increased demand for a dwindling supply of locally caught fish. The slight decreases observed in the past few years may have been the result a consistent supply of reasonably-priced fish and competition among vendors during those years. Roadside vendors mporting fish from other islands did compete and may have discouraged local vendors from increasing the price of locally-caught bottomfish in previous years, but the local Department of Health and Public Services shut these down due to health concerns, possibly adding to the rise in prices in the past few years.

Source: The commercial landings data from the major wholesalers.

Calculations: The average price of all bottomfish species combined is calculated by dividing the total bottomfish revenue by the sold weight. The inflation adjustment is made by using the Consumer Price Index (CPI) for Guam and establishing the 1998 figure as the base from which to calculate expansion factors for all previous years (e.g. divide the 1998 CPI by the CPI for any given year), and then multiplying the unadjusted average price by this factor to obtain the adjusted average price for the given year. A new "market basket" was created by the Department of Commerce in 1998 which resulted in the CPI figure being reset again this year.

Year	Unadjusted $/lb	Adjusted $/lb
80	1.22	4.43
81	1.78	5.35
82	1.93	5.52
83	1.81	5.00
84	2.00	5.09
85	1.91	4.69
86	1.85	4.42
87	1.86	4.26
88	1.87	4.07
89	2.42	4.74
90	2.66	4.57
91	2.81	4.36
92	2.84	4.01
93	2.90	3.78
94	3.47	3.87
95	3.29	3.48
96	2.66	2.68
97	2.99	3.01
98	3.30	3.31
99	**3.61**	**3.61**
Average	2.46	4.21
Std. deviation	0.68	0.76

Figure 6. Guam Bottomfish CPUE



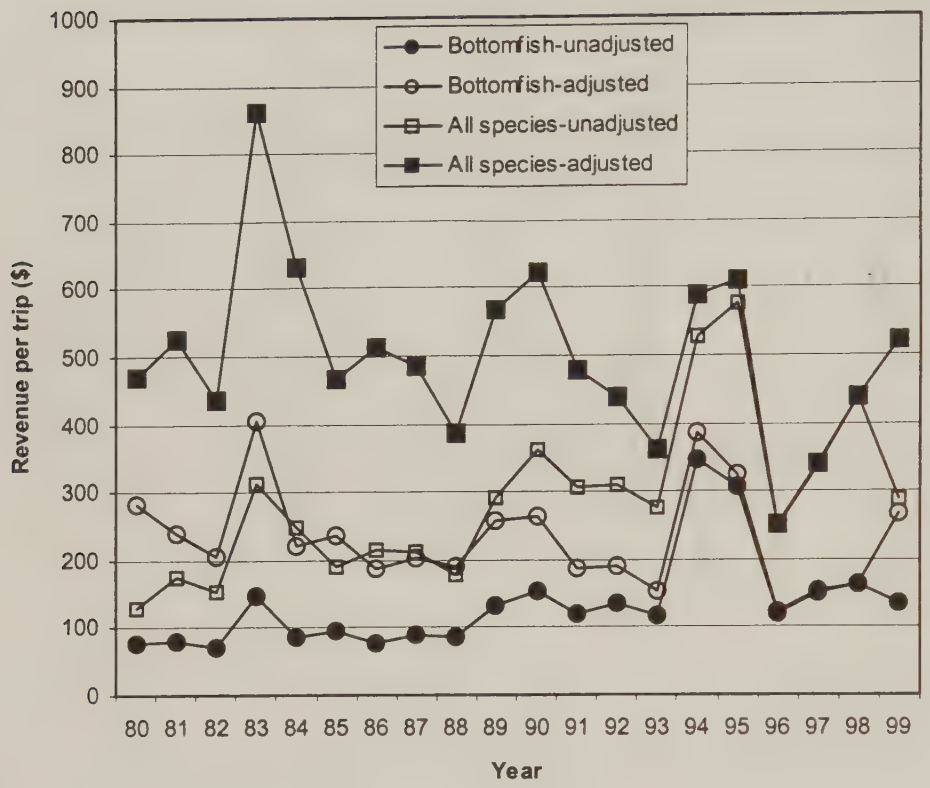
Interpretations: Historically, the annual CPUE has fluctuated around 4 to 6 pounds per hour and has up until the last four years remained fairly stable. In 1995 the CPUE fell below 3.0 pounds per hour, owing in large part to an increasing number of recreational and subsistence-type vessels continuing to enter into the fishery; most of which target the less-productive shallow-water complex of bottomfish in nearshore waters.

Source: The DAWR creel survey data for the bottom fishing method.

Calculations: The yearly catch-per-unit-effort (CPUE) is calculated by using the year-end survey totals and dividing the total weight of bottomfish landed by the total number of hours spent bottomfishing.

Year	CPUE (lbs/hr) All Bottomfishing	Non-charter	Charter
85	5.7	5.7	3.8
86	5.2	5.2	8.9
87	5.8	5.8	8.3
88	4.9	4.9	5.3
89	5.6	5.6	3.8
90	4.5	4.5	3.1
91	4.8	4.9	3.1
92	5.8	5.8	4.4
93	4.2	4.2	3.2
94	5.6	5.7	3.5
95	2.5	2.4	3.2
96	4.1	4.4	2.4
97	3.7	3.9	2.5
98	2.5	2.6	2.2
99	**3.2**	**3.2**	**3.2**
Average	5.8	4.6	4.1
Std. deviation	1.3	1.1	2.0

Figure 7. Guam average revenue per trip



Interpretations: The inflation-adjusted average revenue per trip for both the "bottomfish" and "all species" categories increased in 1999. Previous drops in revenue were due to some of the more experienced fishermen not selling their catch to vendors participating in the DAWR commercial receipt book program. The increase in the amount of imported bottomfish from around Micronesia (Belau, Chuuk, Pohnpei, etc.) that began sometime around 1991 with the addition of frequent airline routes to Guam, may explain the slight decrease in revenues between 1991 and 1993. Roadside vendors have, for the most part, been shut down, and most vendors prefer purchasing locally caught fish. The substantial increases in the inflation-adjusted average revenue per trip in 1994 are best explained by the success of a few highliner vessels during that year. The general higher revenue levels for the "all species" category over the last decade suggests that most commercial fishermen on average continue to make more money from selling other fish than bottomfish.

Source: The commercial landings data from major wholesalers.

Calculations: The average revenue per trip for all species is calculated by summing the revenue of all species sold for any trip which landed bottomfish species, and dividing by the number of trips. The average bottomfish revenue per trips is calculated from those same trips by summing the sales of only bottomfish species and dividing by the number of trips.

Year	$/Trip (Bottomfish) unadjusted	$/Trip (Bottomfish) adjusted	$/Trip (All Species) unadjusted	$/Trip (All Species) adjusted
80	77	281	129	468
81	80	239	174	525
82	71	204	152	436
83	147	406	312	863
84	87	222	248	632
85	96	236	190	465
86	78	186	215	512
87	88	202	212	485
88	87	190	178	387
89	132	258	290	567
90	154	263	363	623
91	120	186	308	480
92	134	190	311	439
93	118	153	277	361
94	346	385	528	589
95	306	324	578	611
96	121	122	250	252
97	151	152	338	340
98	163	163	439	440
99	**266**	**266**	**522**	**522**
Average	141	231	301	500
Std. dev.	78	75	129	131

Appendix 3

Hawaii

CONTENTS

page

Summary 3-2

Historical Annual Statistics 3-3

List of Tables 3-6

List of Figures 3-6

Introduction 3-8

Recommendations 3-9

Tables and Figures 3-10

Summary

None of the five BMUS species for which SPR values can be calculated have 1999 SPR values below the 20% critical threshold that defines recruitment overfishing under the FMP. Estimates range from a low of 34% for onaga to a high of 59% for uku when viewed on an archipelago-wide basis. Implementation of the state bottomfish management plan (which became law in June 1998) should bring an improvement to the locally depleted status of ehu and onaga in the main Hawaiian islands (MHI) and thereby increase the archipelago-wide SPR estimates for these species.

The MHI bottomfish fishery, though showing signs of stress, has been improving over the last few years. Landings recorded to date for1999 are sharply lower (down 20%) than the revised landings reported for 1998. CPUE for the MHI has increased for the past three years and is at a five year high (211 lb/trip in 1999). Stocks of many of the BMUS species in this zone show clear signs of stress. Onaga, ehu and hapuupuu have a yellow light condition due to a drop in partial CPUE below 50% of original values. Opakapaka has not been as severely depleted and a spike in 1999 for uku (up 100% from 1998) take these species out of the danger zone. Using targeted MHI CPUE data, onaga and ehu stocks are severely depleted on a local basis. The MHI SPR values for these species are 7% for onaga and 6% for ehu. These SPR levels are well below the 20% critical threshold that would signify recruitment overfishing if present on a stock-wide basis which would demand immediate action. State bottomfish management measures, when implemented, should meet this need. Hapuupuu SPR values calculated for the MHI are 30% for 1999 (up 25% from 1998) and at a five year high. 1999 SPR values for opakapaka and uku are 31% and 56%, respectively.

Bottomfish resources in the NWHI remain relatively healthy. CPUE on a per trip basis increased 7% from 1998, and is still 60% of the original level in the Mau Zone. CPUE in the Hoomalu zone increased 6% in 1999 and is and 85% of the historical CPUE. On a per day basis CPUE values are down 10% in the Mau zone and 18% in the Hoomalu from the 16 year average. Analysis of SPR and percent immature in the catch show no localized depletion problems to date for any BMUS species in either zone. The mean weight of onaga in the Mau zone, which dropped dramatically in 1998, was an apparent anomaly, as the value rebounded to the 1997 average.

Armorhead stocks outside of the US EEZ experienced a short pulse in recruitment in 1992 which did not carry over into 1993. The 1993 SPR values at Southeast Hancock Seamount are the highest recorded since 1986, but at 2.5%, they still indicate a collapsed fishery. Data for Hancock Seamount has not been available since 1994, but has been available for areas outside of the US EEZ for years through 1997 (1998 and 1999 values are not available). SPR values obtained at Colahan Seamount have been shown to correlate well with values from Hancock Seamount and can be used as a proxy value. The 1997 SPR for Colahan Seamount was 1.1%, indicating a collapsed fishery.

Historical Annual Statistics Main Hawaiian Islands						
Year	Total Landings (lbs)	CPUE (lbs/trip)	Inflation Adjusted Revenue	Price per Pound	Number of Vessels	SPR Average
1986	810348	274	$3,354,000	$4.43	538	33
1987	783569	237	$3,648,000	$4.88	535	25
1988	1164492	329	$4,828,000	$4.36	572	37
1989	1006142	361	$4,296,000	$4.57	537	40
1990	645802	245	$2,910,000	$4.88	501	27
1991	547800	202	$2,074,000	$4.06	469	24
1992	587471	228	$2,130,000	$3.93	407	25
1993	347960	213	$1,722,000	$4.04	403	24
1994	457956	217	$1,963,000	$4.00	423	24
1995	439625	193	$1,946,000	$3.73	400	22
1996	439867	172	$1,669,000	$4.11	466	21
1997	512554	164	$1,669,000	$3.47	495	20
1998	478802	185	$1,629,000	$3.52	493	20
1999	373978	211	$1,279,000	$3.42	412	25
Ave.	614026	231	$2,508,357	$4.07	475	26
s.d.	243730	57	$1,109,716	$0.49	58	6

Historical Annual Statistics Mau Zone						
Year	Total Landings (lbs)	CPUE (lbs/trip)	Inflation Adjusted Revenue	Price per Pound	Number of Vessels	SPR Average
1986	NA	2206	NA	NA	NA	41
1987	NA	2889	NA	NA	NA	50
1988	NA	2136	NA	NA	4	37
1989	118000	4463	$433,000	$3.67	5	91
1990	249000	3435	$817,000	$3.28	14	77
1991	103000	1199	$365,000	$3.54	14	42
1992	71000	1273	$243,000	$3.42	8	38
1993	98000	1321	$300,000	$3.06	8	36
1994	160000	1573	$525,000	$3.28	12	68
1995	166000	1635	$498,000	$3.00	10	45
1996	135000	1543	$437,000	$3.24	13	53
1997	105000	1976	$369,000	$3.51	9	61
1998	66000	1689	$182,000	$2.77	7	42
1999	54000	1808	$172,000	$3.18	7	51
Ave.	120455	2082	$394,636	$3.27	9	52
s.d.	55906	927	$183,740	$0.26	3	16

Historical Annual Statistics Hoomalu Zone						
Year	Total Landings (lbs)	CPUE (lbs/trip)	Inflation Adjusted Revenue	Price per Pound	Number of Vessels	SPR Average
1986	NA	5301	NA	NA	NA	75
1987	NA	8187	NA	NA	NA	113
1988	NA	4702	NA	NA	12	66
1989	184000	5481	$616,000	$3.35	5	70
1990	173000	5403	$564,000	$3.26	5	64
1991	283000	5871	$894,000	$3.16	4	82
1992	353000	9464	$1,193,000	$3.38	5	98
1993	287000	8412	$961,000	$3.35	4	109
1994	283000	6903	$973,000	$3.44	5	64
1995	202000	6130	$636,000	$3.15	5	73
1996	176000	6216	$604,000	$3.43	3	78
1997	241000	6351	$769,000	$3.19	6	65
1998	266000	5315	$779,000	$2.93	7	66
1999	269000	5611	$931,000	$3.46	6	62
Ave.	247000	6382	$810,909	$3.28	6	78
s.d.	57289	1387	$197,801	$0.16	2	17

Tables

page

1. Hawaii Bottomfish species landings and prices, 1998 & 1999 3-35

2. Ho'omalu zone bottomfish vessel, income statement, 2000[1] 3-40

3. Mau zone bottomfish vessel, income statement, 2000[2] 3-42

Figures

1. Hawaii's bottomfish landings from the NWHI and MHI 3-10

2. NWHI BMUS species composition of landings per trip by weight, for the Mau and Hoomalu Zones 3-12

3. NWHI BMUS species composition of landings by weight 3-15

4. Number of trips made by NWHI bottomfish fleet, Mau and Hoomalu Zones 3-17

5. Number of vessels in the NWHI bottomfish fleet, Mau and Hoomalu Zones 3-19

6. MHI species composition of landings by weight 3-21

7. MHI reported effort and participation 3-23

8. 1998 and historical catch composition by weight in sold catch 3-25

9. Hawaii bottomfish landings, revenue, prices, 1970-present. (Inflation adjusted) 3-26

10. Hawaii bottomfish revenue by source, 1970-present (Inflation adjusted.) 3-29

11. Hawaii bottomfish ex-vessel prices by source, 1970-present (Inflation adjusted) . . . 3-32

12. Hawaii bottomfish ex-vessel prices by NWHI zone, 1989-present (Inflation adjusted) 3-33

13. Hawaii bottomfish demand, 1989-present (total landings vs. price per pound (Inflation adjusted) 3-37

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[1] At the time of this report, no vessel income statement or vessel operating characteristics tables were generated for 1999. The data from the 2000 module is incorporated as a substitute.

[2] See footnote above.

Figures (cont.)

page

14. NWHI bottomfish inflation-adjusted revenue per trip by zone, 1989-present 3-38

15a. CPUE for Hawaiian bottomfish 3-44

15b. Partial CPUE for MHI bottomfish 3-48

15c. Partial targeted CPUE for MHI bottomfish 3-51

16. Percent immature in Hawaiian bottomfish catch 3-54

17. Mean weight of Hawaiian bottomfish 3-56

18. Archipelago wide Spawning potential ratio (SPR) 3-58

19. Spawning potential ratio (SPR) for MHI bottomfish 3-60

19a. Spawning potential ratio (SPR) for MHI bottomfish using targeted CPUE 3-62

19b. Spawning potential ratio (SPR) for NWHI bottomfish using targeted CPUE 3-64

20. Research CPUE on SE Hancock Seamount 3-67

21. Armorhead Spawning potential ratio 3-70

22. CPUE for Hancock and Colahan Seamounts 3-70

Introduction

The commercial bottomfish stocks in the Hawaiian Islands are divided into two fisheries: seamount groundfish and deep-slope bottomfish. The seamount fishery targets alfonsin, *Beryx* spp., and armorhead, *Pseudopentaceros wheeleri*. The only area in the US EEZ for this fishery is Southeast Hancock Seamount located 1,400 nm northwest of Honolulu. This trawl fishery was started by the Russians and Japanese in the late 1960s and large catches were made for about 10 years until they caused a crash in the fishery. This fishery has never been domestically harvested. A moratorium on fishing within the US EEZ began in 1986 and continues through the present as no substantial recovery in the fishery has been observed.

The deep-slope bottomfish fishery in Hawaii concentrates on species of eteline snappers, carangids, and a single species of grouper concentrated at depths of 30-150 fathoms. These fish have been fished on a subsistence basis since ancient times and commercially for at least 90 years. The deep-slope fishing grounds within the US EEZ are divided into three management zones. The inhabited main Hawaiian Islands (MHI) support numerous subsistence, recreational, and commercial fishermen with considerable overlap by category. The uninhabited Northwestern Hawaiian Islands (NWHI) are divided into the Mau Zone, closer to the MHI, and the Hoomalu Zone. Fishing in these zones is conducted solely by commercial fishermen and requires federal licensing for such activities. The Hoomalu Zone is a limited entry zone with 6 vessels participating in 1999; 7 vessels fished the Mau Zone in the same year.

Vessel size varies considerably with larger fully commercial vessels (30 ft in length and over) conducting trips of about 10 days, and smaller vessels (<30 ft) generally restricted to the MHI and trips of 1-3 days. Most vessels in this fishery are fully outfitted with electronic navigation and fish-finding equipment, as well as with electric or hydraulic line-hauling equipment. The catch is sold fresh in the round for local consumption.

Catch and revenue data for bottomfish have been collected by the State of Hawaii Division of Aquatic Resources (HDAR) since 1948 in the form of a report submitted by commercial fishermen. No data is collected for recreational or subsistence fishermen, but their catch is estimated to be about equal to the commercial catch in the MHI. Data obtained from a market monitoring program and data from fishermen interviews are combined with the HDAR data set for most of the analysis presented in this report.

1998 Recommendations

1) The BPT recommends that the Council amend the FMP to become fully consistent with the State of Hawaii Administrative Rule 13-94 on MHI bottomfish. This would include closure of areas within the federal jurisdiction as specified in the administrative rule.

Status:
The Council elected to not pursue these amendments to the Bottomfish FMP due to adequate level of enforcement already occurring.

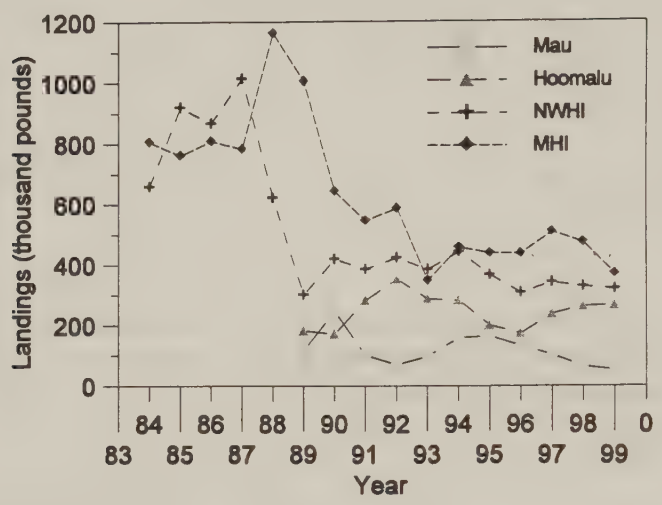
2) The BPT recommends that the Council encourage and assist the State of Hawaii DLNR in the implementation of a postcard survey of non-commercial bottomfish fishermen as determined from the State's BF vessel identification permit list. This survey would be used to estimate recreational catch of bottomfish in the MHI.

Status:
This issue is under consideration by the recently formed Recreational Fishing Task Force.

1999 Recommendations

There were no recommendations from the Bottomfish Plan Team as of their April 1999 meeting.

Figure 1. Hawaii's bottomfish landings from the NWHI and MHI



	Landings (1000 lb)			
Year	**Mau**	**Hoomalu**	**Total NWHI**	**MHI[2]**
1984	NA	NA	661	807
1985	NA	NA	922	763
1986	NA	NA	869	810
1987	NA	NA	1015	783
1988	NA	NA	625	1164
1989	118	184	303	1006
1990	249	173	421	646
1991[1]	103	283	387	548
1992[1]	71	353	424	587
1993[1]	98	287	385	348
1994[1]	160	283	443	458
1995[1]	166	202	369	440
1996[1]	135	176	311	440
1997[1]	105	241	346	513
1998[1]	66	266	332	479
1999[1]	**54**	**269**	**323**	**374[3]**
mean	120.45	247.00	508.50	845.94
s.d.	55.91	57.29	236.09	804.27

[1] NWHI data from combination NMFS and HDAR
[2] Data from HDAR
[3] Preliminary data expanded for full year estimate

Source: Data are from HDAR. Data are only those from BMUS and other bottomfish species. Pelagic species data were not included.

Calculation & Adjustment: The HDAR integrated data set provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet. Supplementary collection of data by both HDAR and NMFS at the Honolulu fish auction provides opportunities for the cross-checking of trip and landing information. The detailed information collected at the Honolulu auction is used for other analysis.

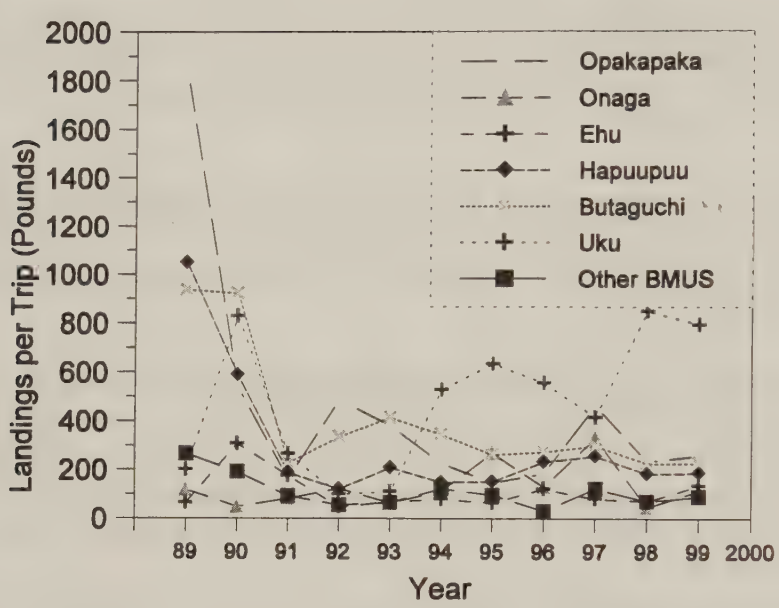
Data in this report are only from those trips that were directed at bottomfish species or in which bottomfish gear was used (zero catch trips or efforts were included). Trolling only trips to the NWHI that were not targeting BMUS are not included. Trolling only trips that resulted in BMUS being caught were included.

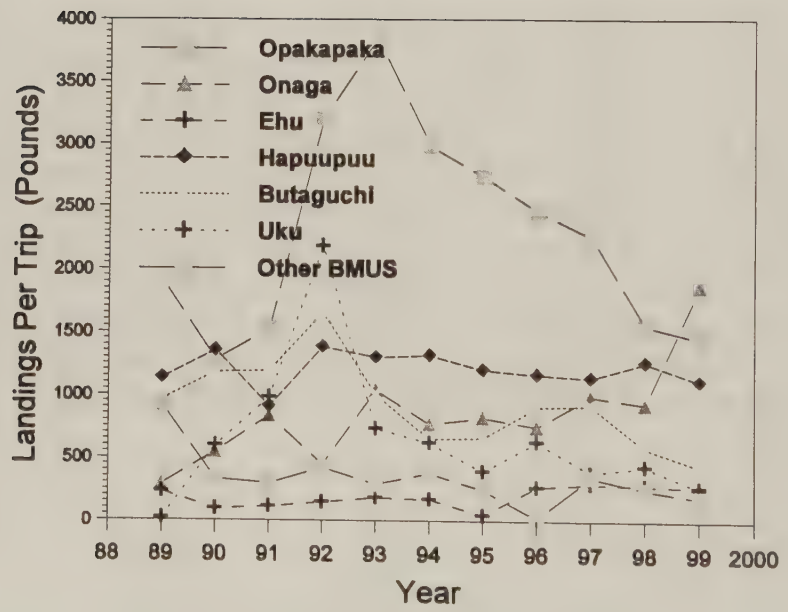
Comments & Interpretation: The 1999 NWHI landings data has remained nearly stable with only a 3% decrease in the BMUS landings. The minimal decrease was mainly due to the Mau zone activity in which there was a 23% drop in number of trips (Fig. 4) despite having a 7% increase in BMUS landings per trip. Hoomalu zone also experienced a minimal increase in BMUS landings per trip(Fig. 2) of 5% and a decrease of 4% in the number of trips.

Hoomalu zone landings have increased for the last 3 years after a low in 1996. The 1997-98 fishing season had an increase in the number of trips and vessels. In mid-1997 there was an addition of 2 vessels into the Hoomalu zone fleet. These additions combined to increase the 1998 effort and landings. The nearly static 1999 landings reflect the stable (limited entry) participation and its nearly identical fishing activity level.

Overall Mau zone landings continued to decline in 1999. The landings have declined since the last high in 1995. The declines are related to the decreasing participation and highlights the multi-purpose, multi-fishery type fishing operations that comprise the normal operating procedure of the Mau zone participants. Mau zone vessels are now primarily part-time and combination troll/bottomfish multi-fishery vessels. There are very few if any full-time bottomfish vessels that fish for bottomfish on a full time basis in the Mau zone. An example of the effects of a full time highliner vessel entering the fishery can be seen in the landings from 1994-1997. In 1994 a full-time commercial bottomfish fisherman entered the Mau zone fishery and immediately made a large impact on the total landings for the duration of its participation through mid-1997. The same highliner vessel then entered the Hoomalu zone fishery(where the effects can also be seen as increased catch) late in 1997 whereupon it made an immediate impact on the volume of landings.

Figure 2. Northwestern Hawaiian Islands BMUS species composition of landings per trip, by weight, for the Mau and Hoomalu Zones





NWHI BMUS average pounds per trip by species, Mau Zone

Species	1990	1991[1]	1992[1]	1993[1]	1994[1]	1995[1]	1996[2]	1997[2]	1998[2]	1999[2]
Opakapaka	541	163	488	382	229	149	187	465	235	259
Onaga	49	83	124	66	114	270	132	331	47	115
Ehu	309	176	48	69	81	65	123	82	72	136
Hapuupuu	590	189	121	210	150	153	235	257	184	187
Butaguchi	923	228	336	415	346	264	276	300	227	227
Uku	830	266	100	112	529	635	558	417	852	796
Other BMUS	193	94	56	67	124	99	32	124	72	91
Total per trip	3435	1199	1273	1321	1573	1635	1543	1976	1689	1811

[1] Data from combination of NMFS and HDAR data sets.
[2] Data from HDAR data set.

NWHI BMUS average pounds per trip by species, Hoomalu Zone

Species	1990	1991[1]	1992[1]	1993[1]	1994[1]	1995[1]	1996[2]	1997[2]	1998[2]	1999[2]
Opakapaka	1284	1530	3208	3849	2984	2741	2426	2258	1556	1454
Onaga	550	837	450	1042	771	825	752	993	931	1872
Ehu	94	113	148	185	172	47	272	298	285	273
Hapuupuu	1357	913	1386	1305	1318	1206	1166	1141	1266	1119
Butaguchi	1185	1196	1660	1004	655	665	909	923	583	439
Uku	600	985	2187	736	623	397	632	387	438	266
Other BMUS	333	297	425	291	380	249	21	351	256	188
Total per trip	5403	5871	9464	8412	6903	6130	6216	6351	5315	5611

[1] Data from combination of NMFS and HDAR data sets.
[2] Data from HDAR data set.

Source: The 1999 data are primarily from HDAR. Data are only those from BMUS. Pelagic species data were not included.

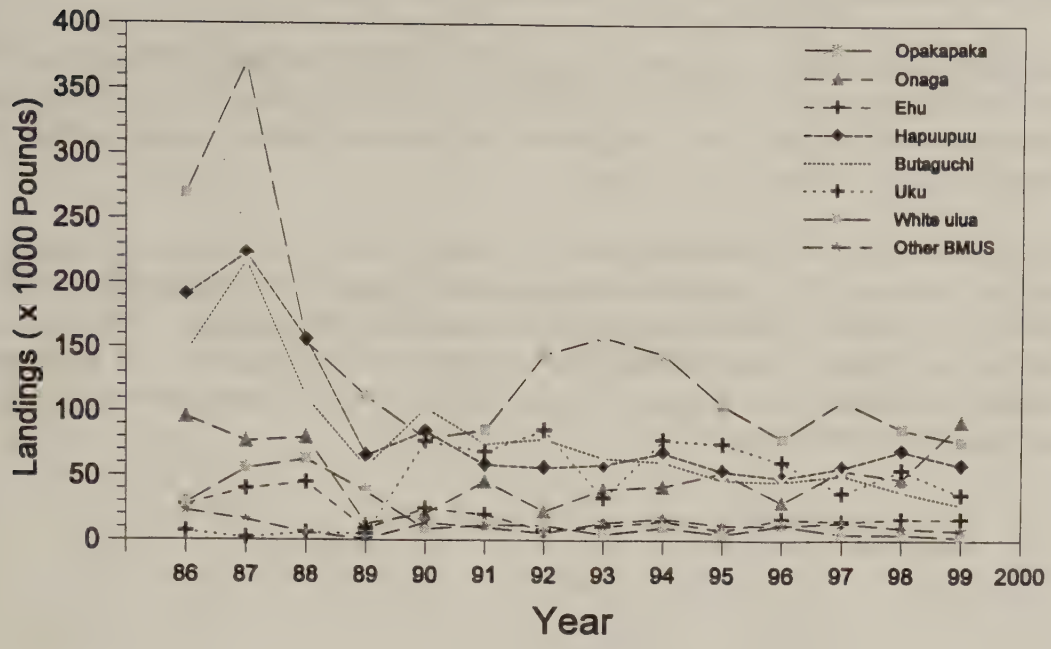
Calculation & Adjustment: The BMUS data were totaled by zone and divided by the number of trips to each zone.

Comments & Interpretations: Mau zone BMUS landings per trip have increased 7% in 1999 despite a drop in overall BMUS landings volume (Fig. 1) and number of trips (Fig. 4). The pounds per trip volume in 1999 is higher than those of all but 1 year (1997) since 1990. The majority of the 1999 increase is in the landing of onaga, ehu, and opakapaka. Targeting on onaga also results in an increased catch of ehu (as opposed to other species) as both species are found in the same depth ranges. The large decrease in the landings of onaga and opakapaka in 1998 was not unexpected as a highliner vessel did exit the fishery in mid-1997.

Although the Mau zone participants were operating under the new limited entry regulations (effective from mid-1999) it is not clear to what extent the new "use or lose" regulations affected the fishing strategies of the participants or the increase in BMUS landings in 1999. The "use or lose" regulations require the participants to make 5 trips in which a minimum of 500 lbs of BMUS species must be caught and reported to maintain a Mau zone limited entry permit.

Hoomalu zone per trip landings have increased 5% in 1999. Pounds per trip for 1998 (being the lowest in recent history) and 1999 are less than those since 1991. The 1999 onaga pounds per trip increased 101% while all other BMUS landings decreased. Uku landings are down from their latest high in 1996. Uku, Other BMUS, and butaguchi had the largest decreases in landings.

Figure 3. NWHI BMUS species composition of landings by weight



Data table for Figure 3 (in thousands of pounds)

Species	1988	1989	1990	1991[1]	1992[1]	1993[1]	1994[1]	1995[1]	1996[2]	1997[2]	1998[2]	1999[2]
Opakapaka	154	112	79	86	145	158	145	105	79	109	87	77
Onaga	80	13	21	46	23	40	42	53	30	55	48	93
Ehu	45	9	25	20	8	11	15	8	17	15	17	17
Hapuupuu	156	66	85	59	57	59	68	54	49	57	70	59
Butaguchi	111	57	103	75	79	64	61	47	46	51	38	28
Uku	6	5	77	69	86	33	78	75	61	37	55	36
White ulua	63	38	9	12	12	5	10	5	12	5	5	3
Other BMUS	6	1	14	10	6	14	17	12	12	14	10	8

[1] Data from a combination of NMFS and HDAR data.
[2] Data from HDAR data set.

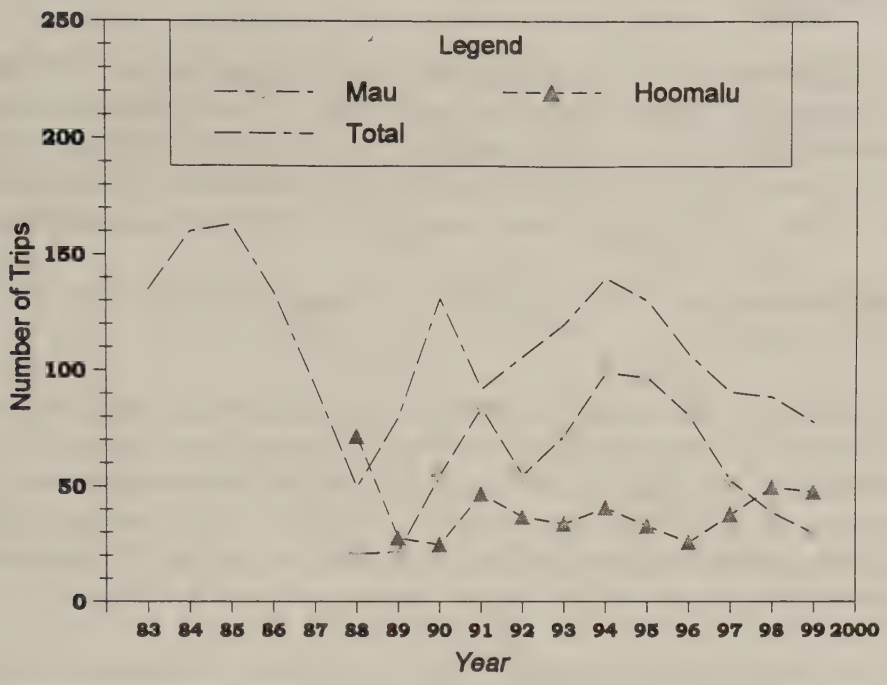
Source: Data for 1999 is from the HDAR integrated data set. Data for 1991-1995 are from a combination of HDAR and NMFS market monitoring program. Data from 1987-1990 are expanded NMFS estimates.

Calculation & Adjustment: HDAR data was compiled and used.

Comments & Interpretation: The overall trends of the NWHI bottomfish fishery show that landings of BMUS have remained in the 3-400,000 lb range since 1988. The 1999 landings are only 3% less than those in 1998. The 18% decrease in Mau zone landed volume was not offset by the Hoomalu zone's minimal 1% increase.

Onaga was the only species to show an increase in landings while ehu remained the same. Onaga landings increased 94% and indicates an increased availability of this species. Time spent targeting onaga are necessarily lost for targeting (and catching) other species. This trend is probably due to the effects of species availability and the fishermen consequently targeting on the most readily available species of value. The largest decreases in landings were for uku, hapuupuu, opakapaka, and butaguchi.

Figure 4. Number of trips made by NWHI bottomfish fleet, Mau and Hoomalu Zones



	Trips		
Year	Mau	Hoomalu	Total
1984	NA	NA	135
1985	NA	NA	160
1986	NA	NA	163
1987	NA	NA	134
1988	21	72	93
1989	22	28	50
1990	55	25	80
1991[1]	84	47	131
1992[1]	55	37	92
1993[1]	72	34	106
1994[1]	99	41	140
1995[1]	97	33	130
1996[2]	81	26	107
1997[2]	53	38	91
1998[2]	39	50	89
1999[2]	**30**	**48**	**78**
mean	59.00	39.92	111.19
s.d.	27.71	13.15	31.83

[1] Based on combined NMFS and HDAR data.
[2] Based on HDAR data.

Source: Data for 1999 was from HDAR. Data for 1991-1995 are from a combination of HDAR and NMFS market monitoring program and the HDAR fast-track data system. Data from 1986-1990 are NMFS estimates.

Calculation & Adjustment: HDAR data was used in 1999. The data for 1995 have been updated. The trips were totaled by management area fished. Data in this report are only from those trips that were directed at bottomfish species or in which bottomfish gear was used (zero catch trips or efforts were included). Trolling only trips to the NWHI that were not targeting BMUS are not included. Trolling only trips that resulted in BMUS being caught were included.

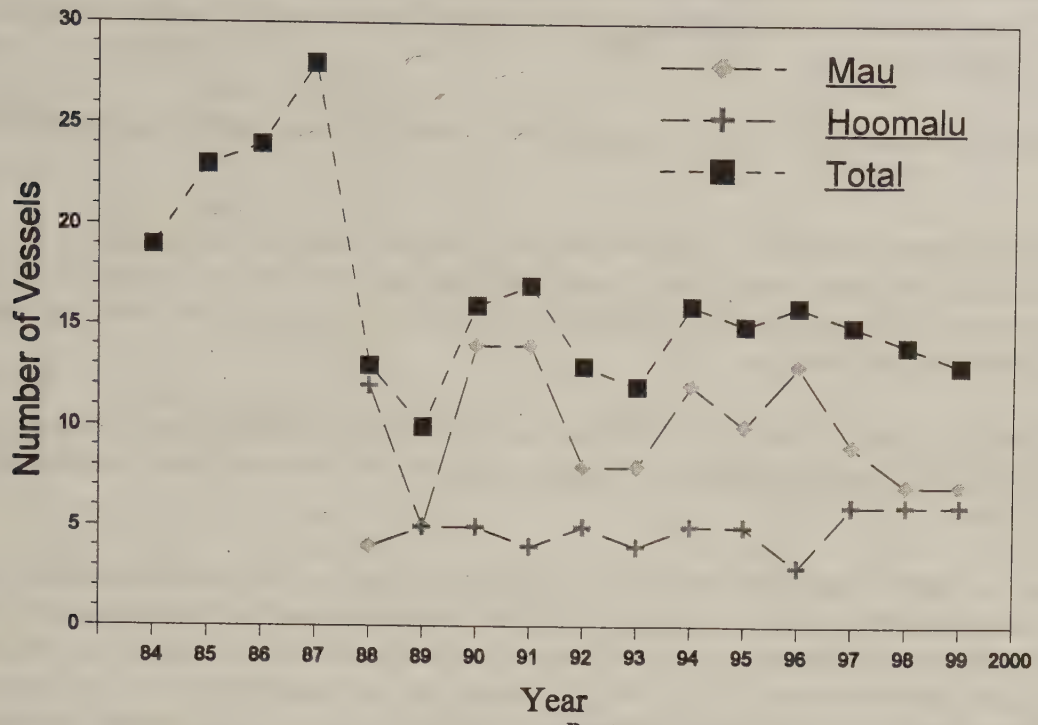
Comments & Interpretation: The overall trend in the number of trips to the NWHI areas has been one of decline since 1994.

The number of trips to the Mau zone has been declining since 1994 and remains below those of the 1990-1998 seasons. The elevated numbers of trips which occurred during the 1994-1997 time period represents the addition of a dedicated full-time fisherman into the fishery. His subsequent departure into the Hoomalu zone fishery in mid-1997 is witnessed by the decrease in the Mau zone trips in subsequent years and an elevation in the number of Hoomalu trips from 1997 to the present.

The majority of the Mau zone participants are not strictly bottomfish fishermen. Instead, they opportunistically target pelagic species more often than they target bottomfish species. Some trips are trolling only trips that also catch uku and white ulua. They have many more trips that are directed at the weather bouys and Mau zone areas for troll and other activities such as palu-ahi, ika-shibi, and kona crabbing. Species availability, weather conditions, and market price and demand may be the driving factor in the decision to do the multiple target trips or to change target species during a trip.

The number of Hoomalu zone fishing trips has remained nearly constant for the past couple of years decreasing by just 2 trips in 1999. The average number of trips per vessel has stabilized at between 6-8 for the past 5 years. The number of vessels has stabilized at 6 for the past 3 years(Fig. 5). The increase in the number of trips during the past 3 years started with the mid-1997 addition of 2 new vessels. This follows the poor participation in 1996 during which time participation dwindled to just 3 full time vessels. The number of vessels fishing in the access restricted Hoomalu zone had remained relatively constant at 4-6 vessels per year since 1989 when the limited entry plan went into effect. The Hoomalu zone vessel operations differ from the Mau zone by being full-time bottomfish vessels rather than an opportunistic kind of operation. The fluctuating abundance of the high value species affords them opportunistic targeting opportunities.

Figure 5. Number of vessels in the NWHI bottomfish fleet, Mau and Hoomalu Zones



	Boats		
Year	Mau	Hoomalu	Total[2]
1984	NA	NA	19
1985	NA	NA	23
1986	NA	NA	24
1987	NA	NA	28
1988	4	12	13
1989	5	5	10
1990	14	5	16
1991[1]	14	4	17
1992[1]	8	5	13
1993[1]	8	4	12
1994[1]	12	5	16
1995[1]	10	5	15
1996[3]	13	3	16
1997[3]	9	6	15
1998[2]	7	6	13
1999[3]	**7**	6	**13**
mean	9.25	5.50	16.44
s.d.	3.39	2.24	4.86

[1] Based on a combination NMFS and HDAR data set.

[2] [3] Total may not match sum of areas due to vessel participation in multiple areas. Based on HDAR data.

Source: Data for 1999 was from HDAR. Data for 1991-1995 are from a combination of HDAR and NMFS market monitoring program and the HDAR fast-track data system. Data from 1984-1990 are NMFS estimates.

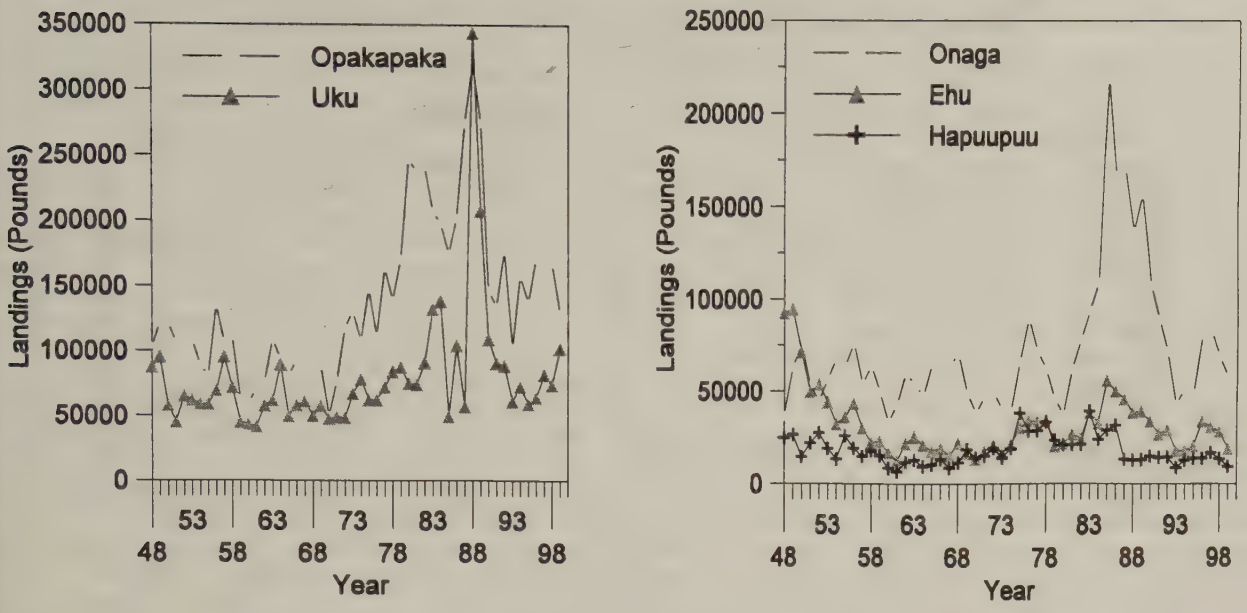
Calculation & Adjustment: The 1999 number of vessels were totaled by management area fished.

Comments & Interpretation: The total number of participants has remained at 13 for two years running. Although the number of participants has been stable for the last 2 years the Mau zone has experienced a decrease in activity (# trips, Fig. 4) level. Trip numbers for the Hoomalu zone have decreased slightly this year.

The Hoomalu zone participation has remained at 6 for the last 3 years. The number of trips has decreased by 2 from last year but the average number of trips per vessel has remained at 6-8 for the last 5 years.

The Mau zone vessel participation has not changed from last year. In the past the Mau zone was more dynamic in terms of vessel participation both in numbers and individual vessels. The original open access designation allowed vessel operators to accumulate experience before fishing the more distant areas of the NWHI. Thus owners and operators of smaller vessels from the MHI could gain valuable experience before deciding if they would like to eventually fish the upper limited access zone. In 1996 due to fishermen's economic concerns, the Mau Zone Task Force was formed to address the problem and suggest possible solutions. The Task Force moved in the direction of a limited entry fishery much like the Hoomalu zone and the subsequent 1997 moratorium on additional new participants essentially capped the fleet pending new regulations. The moratorium itself had reduced the number of vessels from 13 in 1996 to 9 in 1997 to 7 in 1998. The new limited entry regulations and its initial qualification criteria were put into effect in mid-1999. It allows all qualifying participants initial entry after which a "use it or lose it" criteria would allow the managers to reduce the fleet to its target number. The assumption that the number of initial entrants would be large was unfounded as there was less interest than expected. It was expected that fleet size reduction would occur rapidly as the Mau zone has historically had a large turnover in annual participation.

Figure 6. MHI species composition of landings by weight



Interpretation: Most species show declining trends continuing from the mid- and late-eighties. The prevailing interannual pattern in landings is episodic versus predictably periodic or constant. 1999 landings for all species are preliminary as they are based on catch reports submitted to date. Earlier years data is essentially complete. Landings for all species were highest in the mid 1980s.

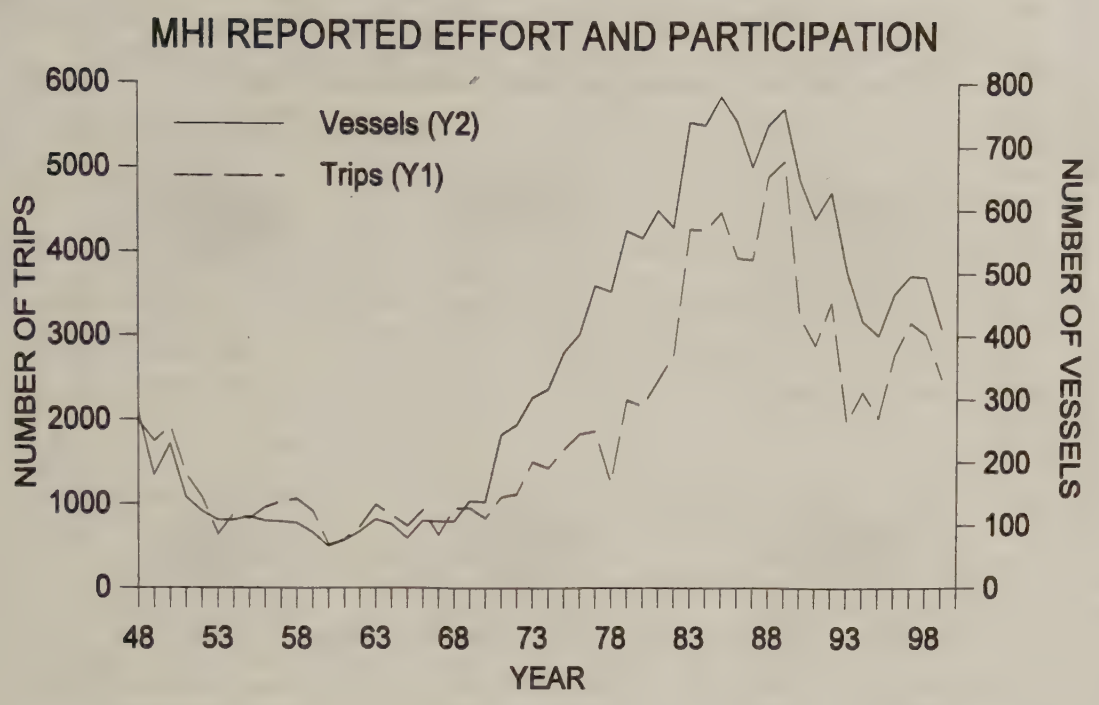
Source: Total commercial landings by species are from HDAR commercial catch report data for the MHI with no screening by gear. 1998 values have been updated from last year's report with an essentially complete data set for that year. 1999 values are preliminary estimates of annual landings based on landings reported to date and should increase for all species by an unknown amount.

Comments: Landings presented here are commercial reported landings only and do not include any expansion for recreational landings.

MHI Landings by Species

YEAR	OPA	ONA	EHU	UKU	HAP
1948	102651	36804	92323	87235	24609
1949	121243	62979	94097	95273	26397
1950	121664	75398	71286	57814	14514
1951	106423	53018	49699	45065	22000
1952	112917	44604	53716	64799	27499
1953	108504	56506	44200	61619	19009
1954	88641	67583	32278	58767	13367
1955	80516	63208	36017	58564	25849
1956	134980	75986	43313	69108	19224
1957	106656	53988	30157	95267	14782
1958	111131	63774	22309	71321	18033
1959	62043	49745	23107	44705	15294
1960	59405	33158	16950	43186	8418
1961	70083	42701	12370	41134	6642
1962	75492	59788	21742	57568	11663
1963	108505	53225	25267	61601	12865
1964	93618	47325	20914	89156	9321
1965	81039	65040	17605	49485	10297
1966	92815	69634	19342	57849	13277
1967	89364	64022	14899	60970	8480
1968	89908	69922	21984	49677	11287
1969	88621	48454	16483	57542	18300
1970	49655	37894	13364	47443	13651
1971	76388	47250	17626	48710	14746
1972	117367	49213	20347	48077	18994
1973	130785	39811	16336	66875	13878
1974	107828	38883	21015	77939	18874
1975	147755	66029	30155	62117	3814
1976	111520	89518	33788	62165	2821
1977	163813	71747	33689	71915	2854
1978	138931	62208	34333	83798	3327
1979	170180	46271	20339	87128	2353
1980	247378	37489	21712	74782	2096
1981	237254	62351	26900	73921	2117
1982	241977	78372	24542	90793	2126
1983	207345	94082	38793	131860	3944
1984	198260	109046	33022	138313	2401
1985	174746	218552	56039	49264	2905
1986	202467	167112	50259	104047	3162
1987	274929	171416	46018	56753	1323
1988	320601	136641	38547	344128	1283
1989	275167	156952	39393	208171	1295
1990	146861	107514	33848	108840	1493
1991	134326	88978	26902	90272	1421
1992	178014	71715	29461	88474	1445
1993	102514	43141	17981	60910	859
1994	158276	51502	18000	72133	1271
1995	137473	48948	20689	59036	1381
1996	171428	80953	33925	63792	1372
1997	172308	82874	30778	81367	1698
1998	167918	69077	28417	73724	1361
1999	**128911**	**57635**	**19178**	**101750**	**938**
mean	138435	71924	31836	78965	1811
s.d.	60561	37599	17469	47128	772

Figure 7. MHI reported effort and participation



Interpretation: Updated data for 1998 show that reported effort and participation declined slightly from 1997 values and are both higher than their long-term means, but much lower than their peaks of the mid 80's. Preliminary 1999 values for effort and participation are based on reports received to date and not expanded for any late reporting. These values are considerably lower than 1998 values but are expected to rise as late reports are submitted.

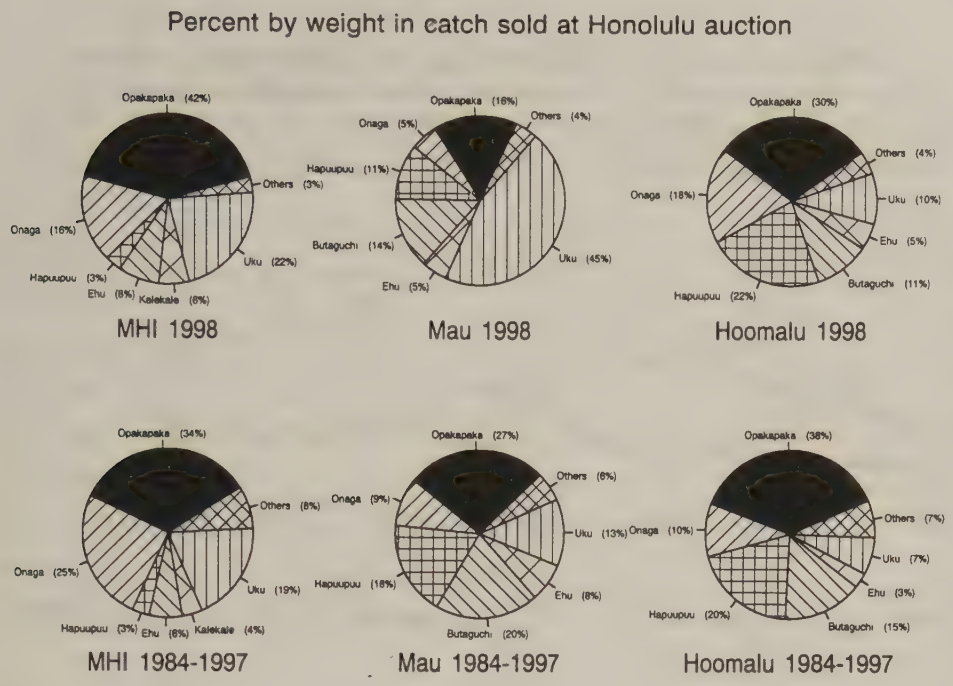
Landings and CPUE for bottomfish trips are tabulated in the following table. These figures differ from those presented in Figure 1 (landings) and Figure 15 (CPUE). Those presented here are screened for bottomfish trips only (as defined below). In Figure 1 landings are for bottomfish species caught on all gears without screening criteria and in Figure 15 data are further screened by area fished and landings of individual fishers to reflect the effective fishing effort required to "standardize" CPUE. 1999 values for each are below their long-term averages, with that for CPUE being by far the lowest on record. It is always a bad sign when landings and CPUE both drop, indicative of resource depletion.

Source: HDAR commercial catch report data.

Calculation & Adjustment: MHI commercial bottomfish trip and vessel values are obtained from the HDAR C3 report data. Participation (# of vessels) is presented as the number of unique license numbers reporting bottomfishing trips for a particular year. For 1948-1993 the reported value for participation is based on the State fiscal year (July-June). For 1994-1999 the participation is reported on a calendar year basis. Trips qualify as bottomfish trips if they use bottomfish handline gear and at least 90% of the catch is of BMUS species.

Yr	# Ves	# Trip	Tot.Lbs	Lbs/Trip
1948	207	1987	323858	162.99
1949	196	1751	338406	193.26
1950	164	1924	302137	157.04
1951	126	1355	282271	208.32
1952	110	1091	232235	212.86
1953	106	650	123867	190.56
1954	103	894	233557	261.25
1955	108	836	197757	236.55
1956	106	975	257183	263.78
1957	102	1041	239485	230.05
1958	96	1075	238138	221.52
1959	76	929	213322	229.63
1960	69	527	148339	281.48
1961	65	586	171768	293.12
1962	98	742	219203	295.42
1963	110	1001	290690	290.40
1964	87	876	297039	339.09
1965	85	750	237624	316.83
1966	97	940	274293	291.80
1967	99	641	236588	369.09
1968	116	959	252305	263.09
1969	130	964	232754	241.45
1970	219	841	169792	201.89
1971	198	1093	173001	158.28
1972	185	1135	194967	171.78
1973	238	1511	246341	163.03
1974	241	1442	218750	151.70
1975	295	1664	322986	194.10
1976	306	1845	301071	163.18
1977	377	1881	323991	172.24
1978	414	1268	272620	215.00
1979	423	2251	316132	140.44
1980	461	2181	372369	170.73
1981	430	2481	392205	158.08
1982	526	2790	432259	154.93
1983	541	4283	484603	113.15
1984	558	4272	428608	100.33
1985	583	4481	476457	106.33
1986	538	3939	476745	121.03
1987	535	3920	475313	121.25
1988	572	4911	687379	139.97
1989	537	5091	634691	124.67
1990	501	3242	338401	104.38
1991	469	2895	285046	98.46
1992	407	3401	329024	96.74
1993	403	1977	199023	100.67
1994	423	2333	226436	97.06
1995	400	2031	194828	95.93
1996	466	2780	253887	91.33
1997	495	3158	288107	91.23
1998	493	3023	268607	88.85
1999	**412**	**2499**	**219441**	**87.81**
mean	290	1983	295113.44	183.54
s.d.	180	1246	113895.55	74.62

Figure 8. 1998 and historical catch composition by weight in sold catch.



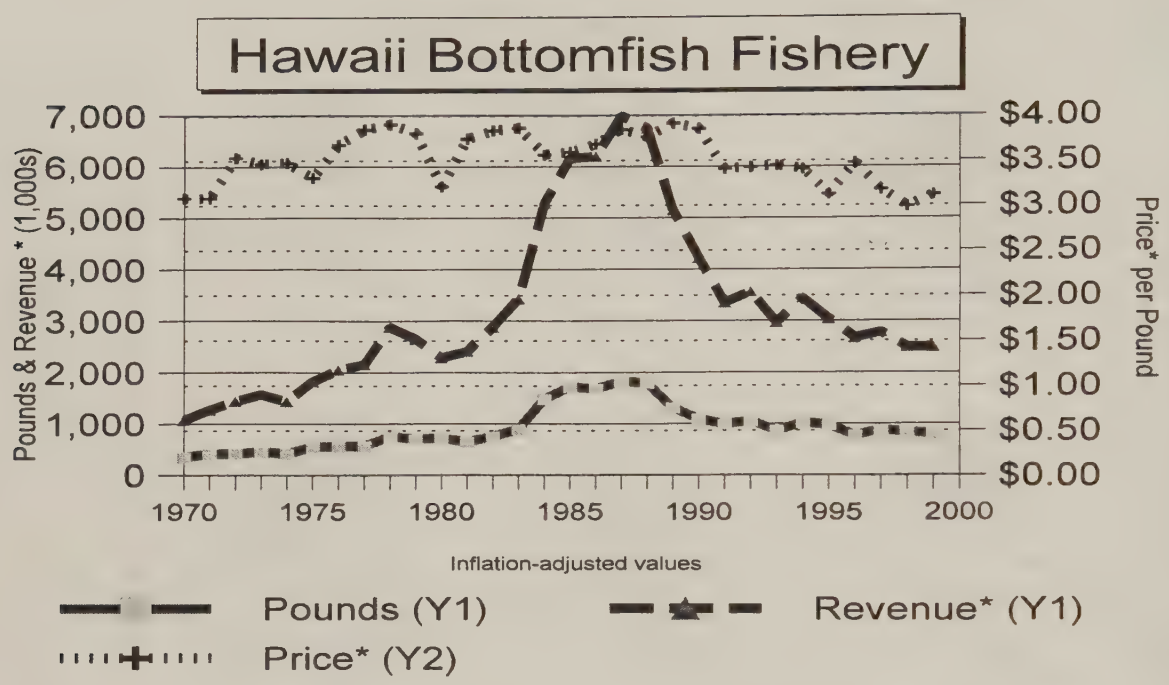
Interpretation: This graph has not been updated since 1998 as the data was not collected in 1999. Data was originally collected to determine whether the catch composition would change from year to year. While some variation occurs, it is not great and likely reflects variation in type of fishing and not variation in catchability.

Regarding the 1998 data, the pattern closely resembles the historical pattern for the MHI and the Hoomalu zone. In 1998 the Mau zone pattern differs from the historical pattern with uku comprising a much larger component of the catch. This type of pattern with a high uku component occurs frequently (last seen in 1996).

Source: Catch composition estimated from Honolulu auction data.

Comments: This reflects only auction-sold fish, and does not include fish that are kept, given away, or sold at other locations. "Others" in the MHI include butaguchi, gindai, white ulua, lehi, and taape. "Others" in the NWHI include kalekale, gindai, white ulua, lehi, and taape.Western Pacific Regional Fishery Management Council

Figure 9. Hawaii bottomfish landings, revenues, prices, 1970 - present. (* Inflation-adjusted.)



Interpretation: After almost twenty years of growth, landings and *real* (inflation-adjusted) revenue peaked in 1987 and have declined by approximately 60% in the twelve years since then. Inflation-adjusted prices have also declined substantially, with 1999 prices up only slightly from 1998's 30 year low. Previous economic research (mid-1980s) showed a considerable relationship between price and landings, but this relationship appears weaker in the 1990s, perhaps due to increased imports of bottomfish from Pacific island nations. Changes in area and species composition may also be changing the aggregate price (discussed later in the report).

Hawaii bottomfish landings, revenue, and price, 1970 - present. (* Inflation-adjusted.)

	Pounds All Areas (1,000s)	Revenue All Areas ($1,000)	Revenue* (Inflation-adjusted)	Price Per Pound (Whole Weight)	Price * (Inflation-adjusted)	HCPI
1970	344	$253	$1,068	$0.73	$3.08	40.90
1971	410	$312	$1,265	$0.76	$3.08	42.60
1972	407	$366	$1,437	$0.90	$3.53	44.00
1973	454	$418	$1,573	$0.92	$3.46	45.90
1974	413	$421	$1,431	$1.02	$3.47	50.80
1975	549	$584	$1,817	$1.06	$3.30	55.50
1976	558	$693	$2,053	$1.24	$3.67	58.30
1977	562	$764	$2,156	$1.36	$3.84	61.20
1978	740	$1,100	$2,883	$1.49	$3.90	65.90
1979	698	$1,123	$2,649	$1.61	$3.80	73.20
1980	713	$1,082	$2,282	$1.52	$3.21	81.90
1981	643	$1,262	$2,408	$1.96	$3.74	90.50
1982	750	$1,600	$2,878	$2.13	$3.83	96.00
1983	887	$1,976	$3,419	$2.23	$3.86	99.80
1984	1,481	$3,192	$5,285	$2.15	$3.56	104.30
1985	1,717	$3,853	$6,167	$2.24	$3.59	107.90
1986	1,682	$3,958	$6,197	$2.35	$3.68	110.30
1987	1,819	$4,687	$6,984	$2.58	$3.84	115.90
1988	1,794	$4,796	$6,745	$2.67	$3.76	122.80
1989	1,314	$3,867	$5,149	$2.94	$3.91	129.70
1990	1,094	$3,371	$4,216	$3.08	$3.85	138.10
1991	984	$2,864	$3,342	$2.91	$3.40	148.00
1992	1,043	$3,199	$3,562	$3.07	$3.42	155.10
1993	862	$2,749	$2,965	$3.19	$3.44	160.10
1994	1,011	$3,277	$3,440	$3.24	$3.40	164.50
1995	972	$2,954	$3,035	$3.04	$3.12	168.10
1996	768	$2,634	$2,665	$3.43	$3.47	170.70
1997	873	$2,761	$2,774	$3.16	$3.17	171.90
1998	834	$2,470	$2,487	$2.96	$2.98	171.50
1999[1]	798	$2,486	$2,486	$3.11	$3.11	172.70
Average	906	$2,169	$3,227	$2.17	$3.52	107.27
Standard Deviation	421	$1,377	$1,624	$0.87	$0.28	45.77

[1] 1999 data are preliminary.

Data: Hawaii Division of Aquatic Resources (HDAR) commercial catch reports are used for all the main Hawaiian Islands (MHI) landings and revenue; HDAR reports are also used for Northwestern Hawaiian Islands (NWHI) landings from 1970-83. NMFS estimates from shoreside monitoring are used for NWHI landings from 1984 - present with more recent years using a combination of HDAR figures and NMFS adjustments.

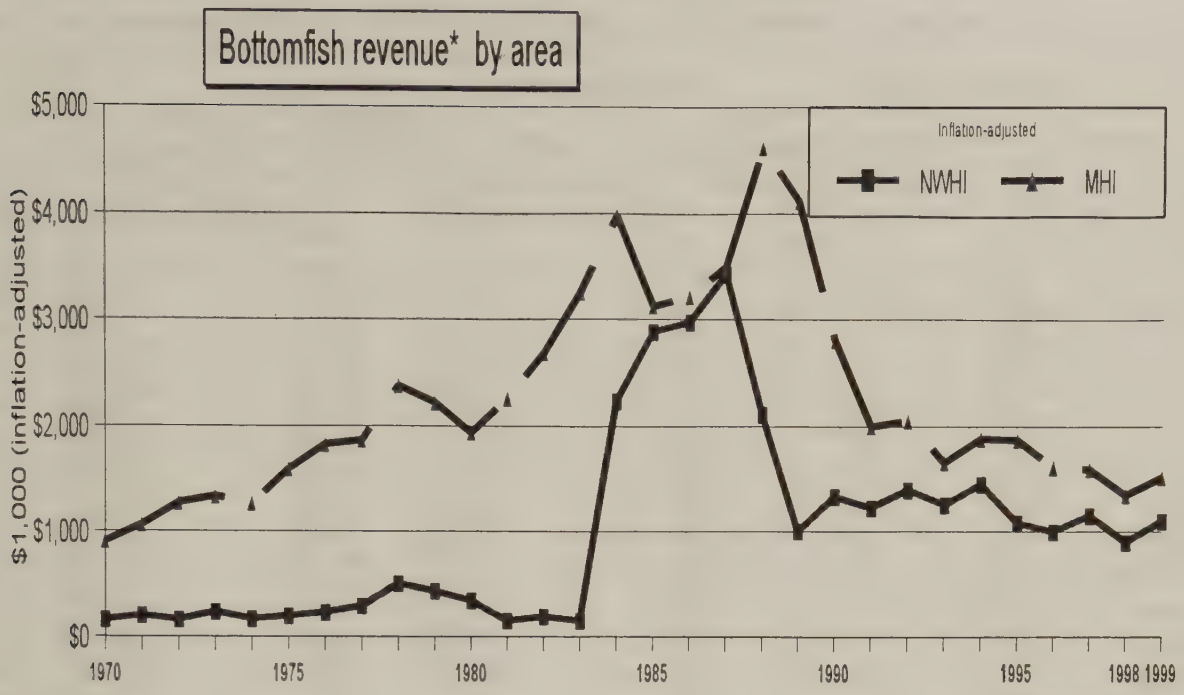
HDAR data for 1999 are preliminary files, representing approximately 87% of 1998 reports for all gears, all species.

Revenue* represents nominal revenue adjusted for inflation by the Honolulu Consumer Price Index (HCPI); revenue* and prices* are adjusted to the current year.

Data source: Data imported from HTOT99a.xls (2/5/01)

Note: Main Hawaiian Islands data for 1999 are preliminary in this report.

Figure 10. Hawaii bottomfish revenue* by source, 1970 - present. (* Inflation adjusted.)



Interpretation: Inflation-adjusted revenue from main Hawaiian Islands bottomfish grew steadily through the 1970s and 1980s as both *real* prices and total landings increased substantially. In 1990, total landings declined dramatically, falling almost 35% that year, and have not recovered in the last decade. Inflation-adjusted prices have also declined by 27% since 1990, with 1999 prices within pennies of a 30 year low. NWHI bottomfish landings grew dramatically in the mid-1980s and then tailed off, stabilizing in the 1990s at a level below the main Hawaiian Islands. Inflation-adjusted revenue in 1999 increased 20% from 1998 and is only 4% below the 1987 peak.

These changes in total landings are related to both catch rates and participation, with the number of vessels active in the NWHI bottomfish fishery in 1999 the lowest in several years and half the peak vessel activity in 1987. More interpretation can be gleaned from discussion in subsequent tables and figures.

Data: Hawaii Division of Aquatic Resources (HDAR) commercial catch reports are used for all the main Hawaiian Islands (MHI) landings and revenue; HDAR reports are also used for Northwestern Hawaiian Islands (NWHI) landings from 1970-83. NMFS estimates from shoreside monitoring are used for NWHI landings from 1984-96. HDAR landings are again used for NWHI landings since 1997.

Revenue* represents nominal revenue adjusted for inflation by the Honolulu Consumer Price Index (HCPI); revenue* and prices* are adjusted to the current year.

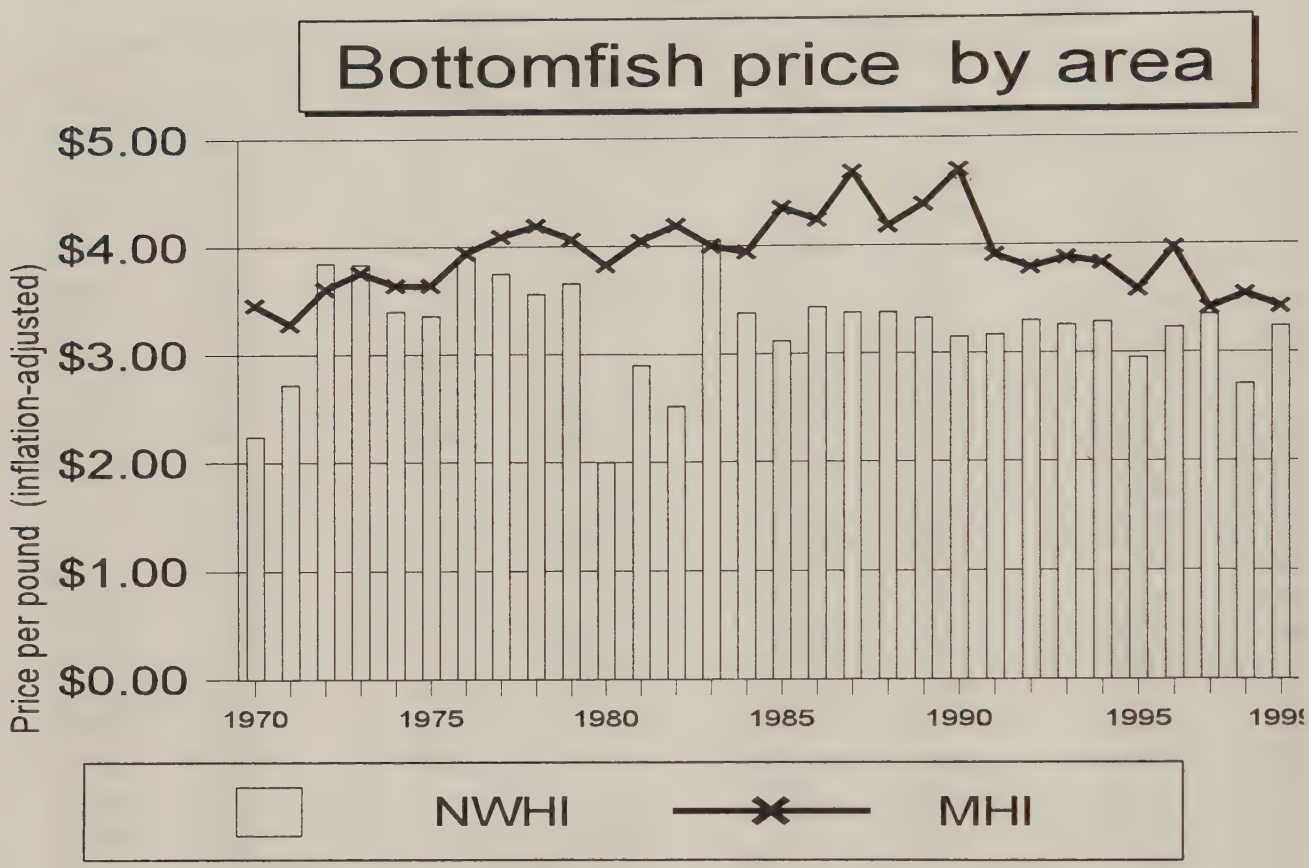
Data source: Data imported from HTOT98a.xls (4/00)

Hawaii bottomfish landings, revenue, and price by source, 1970 - present.
(* Inflation-adjusted.)

	NWHI Pounds	NWHI Revenue (x 1000)	NWHI Revenue* (x 1000) (Inflation-adjusted)	NWHI Aggregate Nominal Price	NWHI Aggregate Price * (Inflation-adjusted)	HCPI
1970	74	$39	$165	$0.53	$2.24	40.90
1971	75	$50	$203	$0.67	$2.72	42.60
1972	43	$42	$165	$0.98	$3.85	44.00
1973	62	$63	$237	$1.02	$3.84	45.90
1974	49	$49	$167	$1.00	$3.40	50.80
1975	59	$64	$199	$1.08	$3.36	55.50
1976	59	$78	$231	$1.32	$3.91	58.30
1977	83	$104	$293	$1.33	$3.75	61.20
1978	143	$194	$508	$1.36	$3.56	65.90
1979	118	$183	$432	$1.55	$3.66	73.20
1980	172	$163	$344	$0.95	$2.00	81.90
1981	52	$79	$151	$1.52	$2.90	90.50
1982	77	$108	$194	$1.40	$2.52	96.00
1983	38	$89	$154	$2.34	$4.05	99.80
1984	661	$1,350	$2,235	$2.04	$3.38	104.30
1985	922	$1,800	$2,881	$1.95	$3.12	107.90
1986	869	$1,900	$2,975	$2.19	$3.43	110.30
1987	1015	$2,300	$3,427	$2.27	$3.38	115.90
1988	625	$1,500	$2,110	$2.40	$3.38	122.80
1989	303	$756	$1,007	$2.50	$3.33	129.70
1990	423	$1,066	$1,333	$2.52	$3.15	138.10
1991	387	$1,053	$1,229	$2.72	$3.17	148.00
1992	424	$1,255	$1,397	$2.96	$3.30	155.10
1993	385	$1,164	$1,256	$3.02	$3.26	160.10
1994	443	$1,382	$1,451	$3.12	$3.28	164.50
1995	369	$1,060	$1,089	$2.87	$2.95	168.10
1996	311	$993	$1,005	$3.19	$3.23	170.70
1997	346	$1,152	$1,157	$3.33	$3.35	171.90
1998	332	$894	$900	$2.69	$2.71	171.50
1999	**340**	**$1,102**	**$1,102**	**$3.24**	**$3.24**	**172.70**
Average	309	$734	$1,000	$2.00	$3.25	107.27
Standard Deviation	273	$666	$910	$0.85	$0.46	45.77

	MHI Pounds	MHI Revenue	MHI Revenue* (Inflation-adjusted)	MHI Aggregate Price	MHI Aggregate Price * (Inflation-adjusted)	HCPI
1970	270	$214	$904	$0.82	$3.46	40.90
1971	335	$262	$1,062	$0.81	$3.28	42.60
1972	364	$324	$1,272	$0.92	$3.61	44.00
1973	392	$355	$1,336	$1.00	$3.76	45.90
1974	364	$372	$1,265	$1.07	$3.64	50.80
1975	485	$513	$1,596	$1.17	$3.64	55.50
1976	499	$615	$1,822	$1.33	$3.94	58.30
1977	479	$660	$1,862	$1.45	$4.09	61.20
1978	597	$906	$2,374	$1.60	$4.19	65.90
1979	580	$940	$2,218	$1.72	$4.06	73.20
1980	541	$919	$1,938	$1.81	$3.82	81.90
1981	591	$1,183	$2,258	$2.12	$4.05	90.50
1982	673	$1,492	$2,684	$2.33	$4.19	96.00
1983	847	$1,882	$3,257	$2.31	$4.00	99.80
1984	803	$1,797	$2,975	$2.38	$3.94	104.30
1985	765	$1,954	$3,127	$2.72	$4.35	107.90
1986	811	$2,052	$3,213	$2.71	$4.24	110.30
1987	785	$2,345	$3,494	$3.14	$4.68	115.90
1988	1,166	$3,288	$4,624	$2.97	$4.18	122.80
1989	1,007	$3,090	$4,114	$3.29	$4.38	129.70
1990	651	$2,242	$2,804	$3.76	$4.70	138.10
1991	562	$1,713	$1,999	$3.35	$3.91	148.00
1992	588	$1,842	$2,051	$3.40	$3.79	155.10
1993	462	$1,535	$1,656	$3.60	$3.88	160.10
1994	536	$1,793	$1,882	$3.65	$3.83	164.50
1995	570	$1,818	$1,868	$3.48	$3.58	168.10
1996	442	$1,593	$1,612	$3.92	$3.97	170.70
1997	519	$1,589	$1,596	$3.39	$3.41	171.90
1998	424	$1,336	$1,345	$3.52	$3.54	171.50
1999	**496**	**$1,517**	**$1,517**	**$3.42**	**$3.42**	**172.70**
Average	**587**	**$1,405**	**$2,191**	**$2.44**	**$3.92**	**107.27**
Standard Deviation	**198**	**$787**	**$896**	**$1.02**	**$0.35**	**45.77**

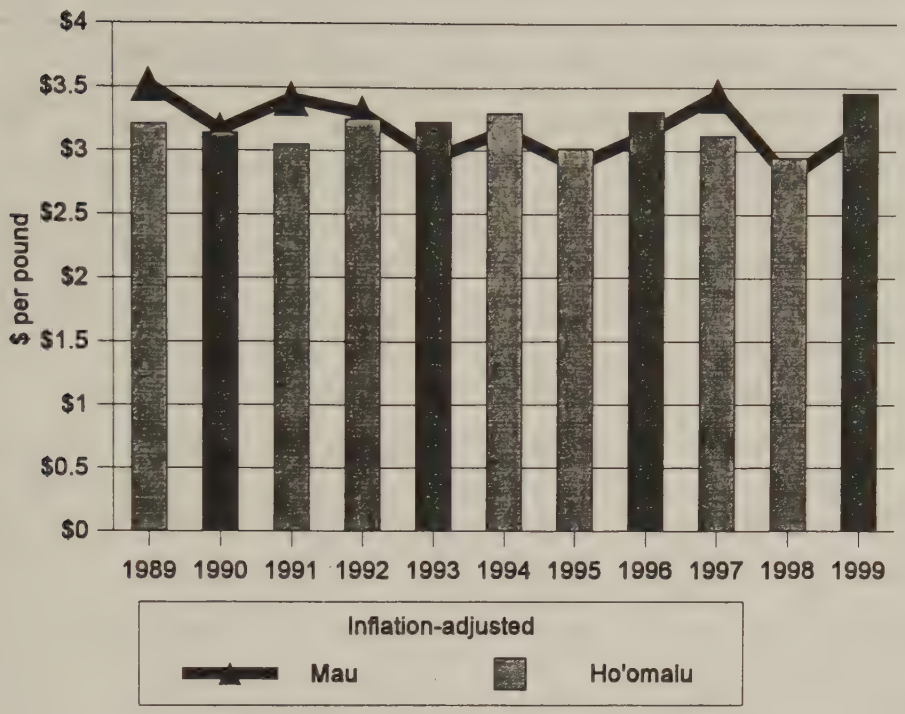
Figure 11. Hawaii bottomfish ex-vessel prices by source, 1970 - present.
(Price* adjusted for inflation.)



Interpretation: Historically, bottomfish caught in the main Hawaiian Islands have tended to have higher aggregate prices, reflecting both species composition and greater freshness. However, in the late 1990s, the prices appeared to converge. This might have reflected a relative lowering of the MHI bottomfish prices, perhaps reflecting the softness of the upscale part of the Hawaii market. Prices diverged in 1998 but converged again in 1999. Revenue from individual species did not vary much in 1999 from 1998, with most species experiencing an inverse relationship between average price and landings. The percentage of the three highest valued species (ehu, onaga, and opakapaka) in total landings increased by 6% in 1999 (compared to 1998). Increased onaga landings (up 44% from 1998) compensated for declines in both ehu and opakapaka.

Data: See Figure 10.

Figure 12. Hawaii Bottomfish Ex-vessel Prices by NWHI zone, 1989 - present.
(* Inflation-adjusted.)



Interpretation: Because of the substantial increase in Mau zone prices in 1997 (delineated by the line in the chart), bottomfish prices for the two zones have become effectively the same over time, although the Ho'omalu zone had a higher percentage of the three top-priced species (ehu, onaga, and opakapaka). In 1999 aggregate prices rebounded from a decline due to a soft market in 1998.

Hawaii Bottomfish Ex-vessel Prices by NWHI zone, 1989 - present.
(Inflation-adjusted prices to current year base)

	Nominal Price per Pound		Inflation-adjusted Price		
Year	**Mau**	**Ho'omalu**	**Mau**	**Ho'omalu**	**HCPI**
1989	$2.64	$2.41	$3.52	$3.21	129.70
1990	$2.53	$2.51	$3.16	$3.14	138.10
1991	$2.92	$2.61	$3.41	$3.05	148.00
1992	$2.96	$2.92	$3.30	$3.25	155.10
1993	$2.73	$2.99	$2.94	$3.23	160.10
1994	$3.00	$3.14	$3.15	$3.30	164.50
1995	$2.80	$2.94	$2.88	$3.02	168.10
1996	$3.09	$3.27	$3.13	$3.31	170.70
1997	$3.42	$3.11	$3.44	$3.12	171.90
1998	$2.77	$2.93	$2.79	$2.95	**171.50**
1999	$3.18	$3.46	$3.18	$3.46	**172.70**
Average	$2.91	$2.94	$3.17	$3.18	159.13
Standard Deviation	$0.26	$0.32	$0.23	$0.15	**14.81**

Data: NWHI prices are compiled from NMFS market monitoring. Inflation-adjusted values are to current year base HCPI (Honolulu Consumer Price Index).

Data source: nwhi98a.xls (10/7/98) ... updated from raw data (4/09/01)

Table 1. Hawaii bottomfish species landings and prices, 1998 & 1999.[2]

	1998		1999	
	Pounds	Revenue	Pounds	Revenue
Butaguchi	41,406	$54,307	31,781	$48,044
Ehu	42,232	$140,905	37,579	$127,130
Hapuupuu	84,510	$204,963	71,875	$201,809
Onaga	109,379	$512,838	157,018	$705,485
Opakapaka	226,330	$954,806	208,911	$872,889
Uku	119,115	$311,476	130,497	$309,808
Ulua	12,998	$15,672	6,136	$7,923
Other BMUS	141,396	$179,590	120,346	$152,149
Other Bottomfish	56,301	$95,638	34,265	$60,544
Total Bottomfish	833,707	$2,470,195	798,408	$2,485,781

	Average Price	
	1998	1999
Butaguchi	$1.50	$1.51
Ehu	$3.34	$3.38
Hapuupuu	$2.43	$2.81
Onaga	$4.69	$4.49
Opakapaka	$4.22	$4.18
Uku	$2.61	$2.37
Ulua	$1.21	$1.29
Other BMUS	$1.27	$1.26
Other Bottomfish	$1.70	$1.77
Total Bottomfish	$2.96	$3.11

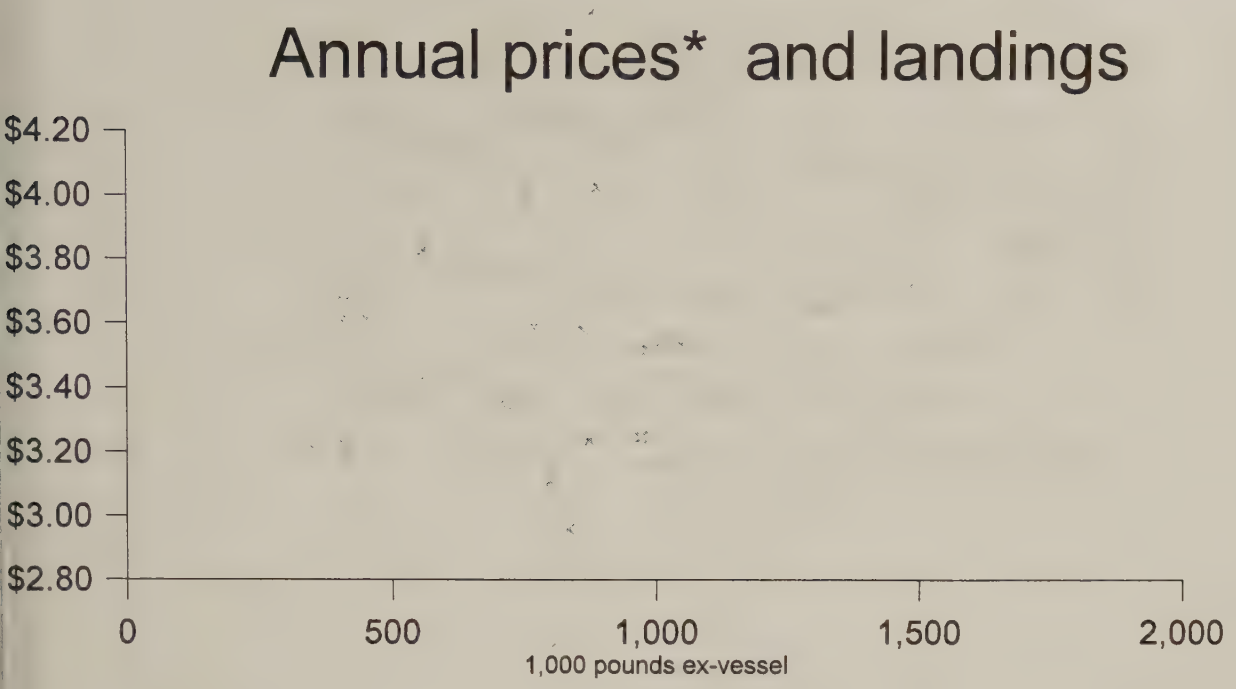
Interpretation: Species prices show the significance of species composition in aggregate statistics. Aggregate bottomfish landings (all species combined from both areas) declined by 4% in 1999, with prices for the major species such as ehu and onaga falling by about that percentage, while hapuupuu prices fell by almost 20% but opakapka prices falling hardly at all. Since landings were lower in 1999, it would appear that the continuing recession in the tourism industry is affecting the market for restaurant grade snappers, groupers, and jacks. However, there was also a substantial increase in imports (as recorded by U.S. Customs[3]), with 440,000 pounds of snapper ($1.2 million) recorded in 1998, compared to 256,000 pounds in 1997 ($1.2 million), and 160,000 pounds ($288,000) in 1995. It would appear that fully one-third of the market is now filled by imports. (Most of these imports were from Tonga.)

[2] Small differences may exist between species totals and area totals due to rounding.

[3] Species identification in the Customs data may be suspect, since a substantial proportion of imports are undifferentiated "fish."

Data & Data Sources: Hawaii Division of Aquatic Resources (HDAR) commercial catch reports are used for all the main Hawaiian Islands (MHI) landings and revenue; HDAR reports are also used for Northwestern Hawaiian Islands (NWHI) landings from 1970-83. NMFS estimates from shoreside monitoring are used for NWHI landings from 1984-96. HDAR landings are again used for NWHI landings since 1997.

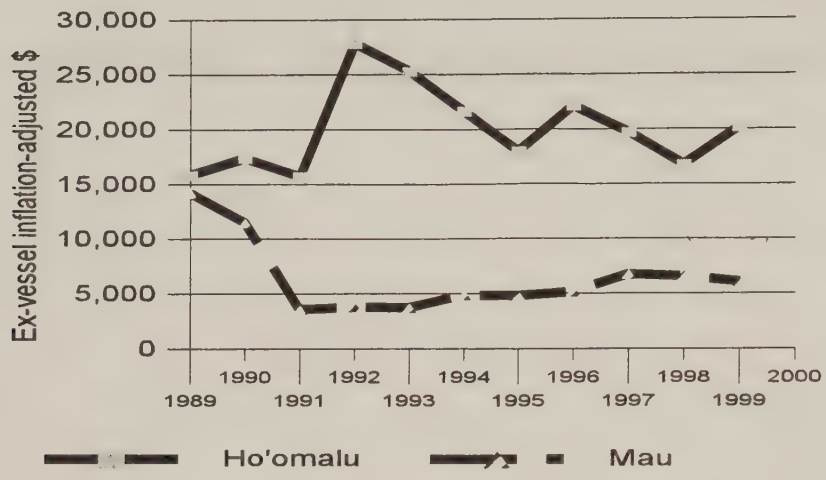
Figure 13. Hawaii bottomfish demand (total domestic landings vs. ex-vessel price, 1970 - present (inflation-adjusted*)



Interpretation: Economic research in the mid-1980s showed a considerable (negative) relationship between weekly bottomfish landings and ex-vessel price. However this relationship is not shown for the annual data. As shown by this and the earlier figure, despite a considerable decrease in total landings, inflation-adjusted ex-vessel price has been quite stable over the past 30 years. The impact of imports may be significant. In 1997 imported snapper and grouper prices were higher than aggregate local prices, although they were lower in 1998.

Data: See Figure 9.

Figure 14. NWHI bottomfish inflation-adjusted revenue* per trip by zone, 1989 - present.



Interpretation: The two trends in inflation-adjusted revenue per trip show the distinct difference between Ho'omalu and Mau zone operations. When the limited entry provisions began to take effect in the Ho'omalu zone in 1989-91, revenue rose dramatically while revenue in the Mau zone fell (as the limited entry vessels could no longer fish in the Mau zone). After that initial drop, however, revenue per trip in the Mau zone has been quite stable. The Ho'omalu zone has shown more variability, with a downward trend from 1992 to 1998 but saw a 20% increase in this past year.

NWHI bottomfish inflation-adjusted revenue* per trip by zone, 1989 - present.

	Ho'omalu Zone			Mau Zone		
Year	Revenue* $1,000	Trips	Revenue* per Trip	Revenue* $1,000	Trips	Revenue* per Trip
1989	443	28	15,832	312	22	14,179
1990	435	25	17,387	631	55	11,470
1991	739	47	15,717	301	84	3,583
1992	1,031	37	27,861	210	55	3,821
1993	859	34	25,266	268	72	3,722
1994	889	41	21,685	479	99	4,843
1995	594	33	18,006	465	97	4,791
1996	576	26	22,154	417	81	5,148
1997	750	38	19,729	357	53	6,736
1998	839	50	16,772	257	39	6,579
1999	**970**	**48**	**20,208**	**182**	**30**	**6,067**
Average	739	37	20,056	353	62	6,449
Standard Deviation	203.3	8.8	3,924.7	134.3	26.2	3,388.0

Data: Data are compiled from NMFS shoreside market monitoring for 1984-95 and then combined with HDAR data for 1996 and 1997. Revenue is adjusted for inflation to the current base year by the Honolulu consumer price index.

Data Source: Imported from NWHI99a.xls (4/00)

Table 2. Ho'omalu zone bottomfish vessel, income statement, 2000.

NWHI Bottomfish Vessel
Ho'omalu zone
2000 average: updated 4/9/01

Income Statement			
Revenue			$148,522
Fixed Costs			$71,678
	Capital	$18,056	
	Annual Repair	$12,694	
	Vessel Insurance	$31,516	
	Administrative	$7,441	
	Other	$1,970	
Operating Costs			$114,892
	Fuel & Oil	$9,958	
	Ice	$2,298	
	Bait	$5,253	
	Handling	$14,900	
	Provisions	$7,113	
	Gear and Supplies	$8,426	
	Other (trip basis)	$10,943	
	Crew's income	$35,000	
	Captain's income	$21,000	
	Net on Operations	*$33,631*	
Total Cost			$186,569
Net Revenue			$-38,047

Data source: nwhb00h1.xls (4/09/01)

* At the time of this report, no vessel income statement or vessel operating characteristics was generated for 1999. The data from the 2000 module is incorporated as a substitute.

Vessel Operating Characteristics

Investment	$233,300	
Trips	6.40	
Trip Days: Total & Trip	134	20.90
Fishing Days: Total & Trip	63	9.80
Catch per Day (Lbs): Total	645	
Bottomfish : Other	604	41
Total Catch (Whole lbs)	40,454	
Bottomfish : Other	37,883	2,572
Price per Pound	$3.67	
Bottomfish : Other	$3.74	$2.66
Unallocated trip days	169	
HCPI (1993 base)	1.09	
Fixed Cost rate	1.00	

4/09/01

Interpretation: As in previous years, the average[4] Ho'omalu zone bottomfish fishing vessel failed to cover its total costs through bottomfishing operations in 1999. There was a positive return on operations (Total ex-vessel revenue minus operating costs) of $33,630; presumably other fishing activities or sources of income had to be employed to cover fixed costs ($71,678).[5]

Data: Cost-earnings information was compiled by Hamilton in 1994, and updated to account for inflation and to reflect current operating characteristics.

Data Source: nwhb00h1.xls (4/09/01)

* At the time of this report, no vessel income statement or vessel operating characteristics was generated for 1999. The data from the 2000 module is incorporated as a substitute.

[4] Recalling that in every *average*, some vessels do better, some not as well.

[5] Fixed costs can be covered as well by deferred maintenance, reducing insurance, etc. To the extent that these measures are being taken, they reduce the economic value of the investment.

Table 3. Mau zone bottomfish vessel, income statement, 2000.

NWHI Bottomfish Vessel Mau Zone Operations Only 2000 Average: updated 4/09/01 Income Statement			
Revenue			$38,639
Fixed Costs			$13,301
	Capital	$4,093	
	Annual Repair	$4,840	
	Vessel Insurance	$2,833	
	Administrative	$1,535	
	Other	$0	
Operating Costs			$33,134
	Fuel & Oil	$4,158	
	Ice	$1,094	
	Bait	$1,641	
	Handling	$3,900	
	Provisions	$1,751	
	Gear and Supplies	$2,407	
	Other (trip basis)	$3,283	
	Crew's income	$6,100	
	Captain's income	$8,800	
	Net on Operations	*$5,505*	
Total Cost			$46,435
Net Revenue			($7,796)

nwhb00m1.xls
09Apr01

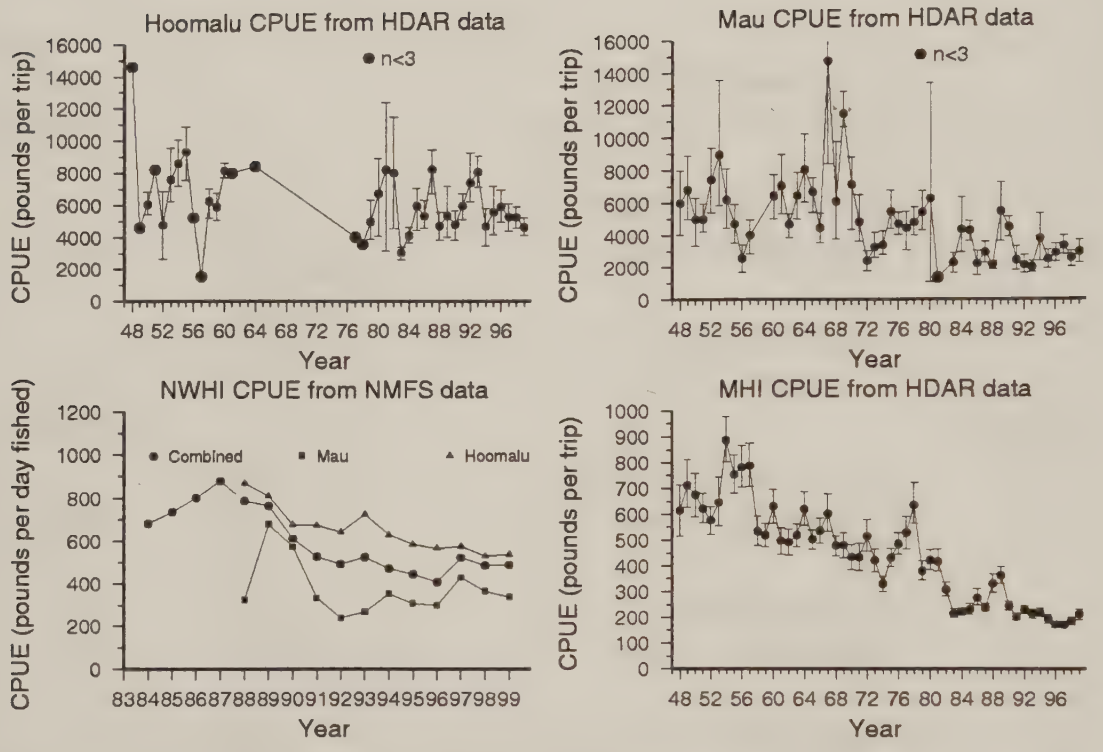
* At the time of this report, no vessel income statement or vessel operating characteristics was generated for 1999. The data from the 2000 module is incorporated as a substitute.

Vessel Operating Characteristics		
Investment	$153,204	
Trips	7.30	
Trip Days: Total & Trip	53	7.30
Fishing Days: Total & Trip	29	4.00
Catch per Day (Lbs): Total	439	
Bottomfish : Other	270	169
Catch per Trip: Total	1,756	
Bottomfish : Other	1,080	676
Total Catch (Whole lbs)	12,819	
Bottomfish : Other	7,884	4,935
Price per Pound	$3.01	
Bottomfish : Other	$3.38	$2.43
Unallocated trip days	245	

Interpretation: Mau zone vessels also failed to cover their costs in 1998, although less of their total operations are (on average) reliant on bottomfish fishing. A more substantial analysis was conducted for the proposed limited entry schema.

* At the time of this report, no vessel income statement or vessel operating characteristics was generated for 1999. The data from the 2000 module is incorporated as a substitute.

Figure 15-a. CPUE for Hawaiian bottomfish



Interpretation: Decreases in MHI CPUE to about 30% of early CPUE values signify a strong yellow light condition for the fishery in this area. The 1999 increase in MHI CPUE was due primarily to a large increase in uku, and to a lesser degree onaga, catches and catch rates. This high CPUE is similar to that of the late 1980s which was due to increased uku catch rates alone and may not indicate an increase in abundance of other species in either case. Rapid decreases in CPUE from the 1989-90 highs may be a return to the prevailing slow decline. The reasons for differing trends in CPUE values for the Hoomalu Zone with differing data sources are unclear, though they could be due to shorter trips with higher CPUE on a per day basis or a change in fleet composition with the new entrants.

Comments: 1999 values for CPUE using the HDAR data set are well below their long-term averages for all three fishing zones with that for the MHI being only about 47% of the long-term average.

There is a long-term decreasing trend in MHI CPUE, with current values approximately one third of the initial five year average. The 1999 MHI CPUE value shows a substantial increase over 1996 and 1997 low values, but the MHI CPUE values from 1991-1999 are still among the lowest values on record. MHI trips are assumed to be one day in length, so CPUE values

presented here reflect catch per day as well as catch per trip.

Source: MHI CPUE is based on HDAR C-3 catch report data from commercial fishermen. Two NWHI CPUE's are presented, one based on the NMFS vessel interview program catch data, and one based on HDAR C-3 catch report data from commercial fishermen.

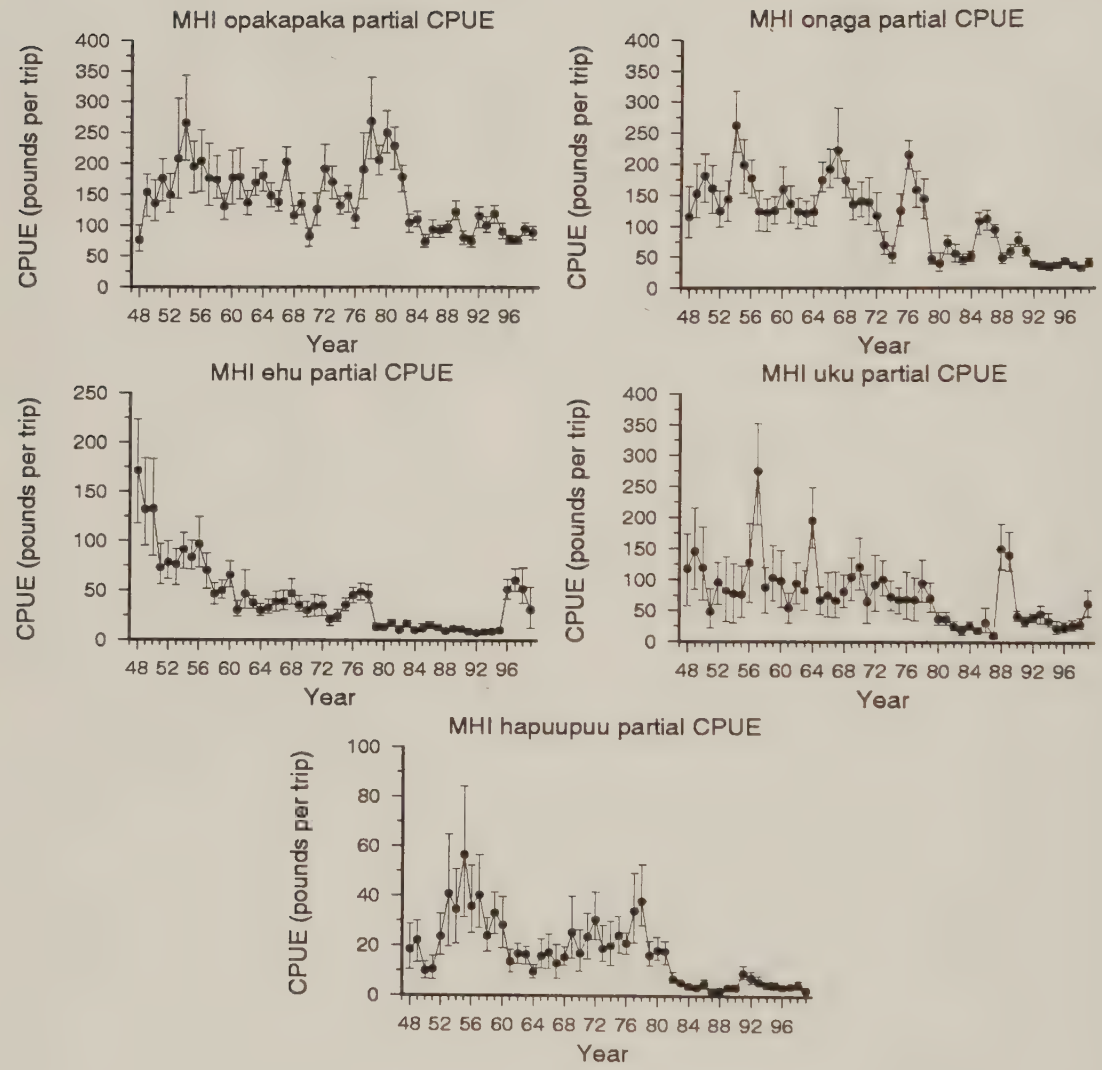
Calculation & Adjustment: MHI trips were screened to only include trips from the areas of Maui, Lanai, Molokai, and Penguin Banks that had at least 90% of the catch by weight in bottomfish. Additionally, some MHI small boats were excluded based on minimum annual landings criteria to correct for temporal changes in the fleet composition (licensees must land at least 30% of the median value of the top ten producers to qualify). The NMFS vessel interview data prior to 1988 does not allow separate Mau and Hoomalu CPUE calculations; therefore, the combined area NWHI CPUE is presented as well. The NWHI HDAR CPUE used data screened to only include trips where at least 90% of the catch by weight was bottomfish and at least 1000 pounds of bottomfish were caught. All catch data reported by the same licensee on consecutive days were collapsed to a trip summary, since 1) most other reports are apparent multi-day trip summaries, and 2) consecutive day reporting may be reflective of marketing rather than fishing activity. There was an apparent absence of Hoomalu Zone trips from the mid-1960s until the late-1970s. The 95% non-parametric confidence intervals for the HDAR CPUE's were calculated by bootstrapping.

Figure 15-a data summaries:

	Pounds/Trip		
Year	MHI	Mau	Hoomalu
1948	614	5968	14635
1949	713	6799	4614
1950	677	4966	6072
1951	621	4980	8228
1952	577	7407	4766
1953	645	8937	7627
1954	887	6158	8613
1955	755	4659	9336
1956	784	2523	5202
1957	789	3958	1535
1958	533	NA	6254
1959	519	NA	5897
1960	630	6379	8139
1961	496	6999	7978
1962	491	4641	NA
1963	518	6410	NA
1964	619	8028	8390
1965	503	6656	NA
1966	536	4413	NA
1967	602	14749	NA
1968	478	6055	NA
1969	480	11484	NA
1970	433	7111	NA
1971	433	4784	NA
1972	514	2386	NA
1973	421	3224	NA
1974	329	3367	NA
1975	430	5439	NA
1976	485	4653	NA
1977	527	4387	4000
1978	635	4753	3550
1979	380	5361	4951
1980	421	6210	6687
1981	416	1336	8167
1982	307	NA	7953
1983	214	2242	3025
1984	220	4308	4085
1985	230	4239	5909
1986	274	2206	5301
1987	237	2889	8187
1988	329	2136	4702
1989	361	5412	5328
1990	245	4454	4793
1991	202	2413	5928
1992	228	2092	7388
1993	213	1992	8040
1994	218	3748	4651
1995	193	2460	5544
1996	172	2823	5870
1997	170	3294	5234
1998	185	2518	5198
1999	**211**	**2899**	**4606**
mean	444.23	4842.96	6220.61
s.d	188.54	2518.15	2262.30

	NMFS NWHI CPUE (lb/day)		
Year	**Mau**	**Hoomalu**	**Combined**
1984	NA	NA	682
1985	NA	NA	736
1986	NA	NA	800
1987	NA	NA	877
1988	322	866	786
1989	677	808	763
1990	573	675	611
1991	333	671	525
1992	239	639	491
1993	267	723	523
1994	353	629	526
1995	306	582	442
1996	298	563	407
1997	429	574	521
1998	364	527	484
1999	**337**	**534**	486
mean	374.83	649.25	607.81
s.d.	128.20	106.65	142.64

Figure 15-b. Partial CPUE for MHI bottomfish



	MHI Partial CPUE (lb/trip)				
Year	**OPA**	**ONA**	**EHU**	**UKU**	**HAP**
1948	77	115	172	117	18
1949	153	153	132	146	22
1950	135	182	132	119	10
1951	176	161	73	48	11
1952	149	124	78	95	24
1953	208	144	76	82	41
1954	266	262	91	77	35
1955	195	198	83	76	56
1956	204	177	97	127	36
1957	176	124	70	275	40
1958	174	121	47	88	24
1959	130	124	50	103	33
1960	177	158	66	97	28
1961	178	136	31	54	13
1962	136	123	47	94	17
1963	169	120	38	82	16
1964	180	122	30	195	9
1965	148	174	33	67	16
1966	138	191	38	75	17
1967	203	222	39	66	13
1968	116	174	47	81	15
1969	135	135	35	104	25
1970	83	140	30	120	17
1971	127	138	34	65	24
1972	192	116	35	92	31
1973	171	70	21	101	19
1974	132	52	24	72	20
1975	149	124	36	68	24
1976	112	214	45	69	21
1977	191	158	49	67	34
1978	269	143	46	94	38
1979	207	47	13	70	16
1980	251	40	13	37	18
1981	229	72	18	37	18
1982	179	55	11	25	7
1983	104	46	17	20	5
1984	109	51	10	26	4
1985	74	107	12	18	3
1986	93	111	15	31	5
1987	91	93	13	10	2
1988	97	48	9	150	2
1989	122	59	12	140	3
1990	80	77	12	42	3
1991	75	60	9	34	9
1992	115	39	8	39	7
1993	100	37	9	46	6
1994	118	34	9	34	4
1995	96	40	11	26	5
1996	77	43	11	24	3
1997	76	36	11	27	4
1998	95	32	8	29	4
1999	**89**	**40**	**6**	**62**	**4**
mean	144.73	110.81	39.65	75.83	16.92
s.d	51.74	58.15	36.08	48.55	12.51

Interpretation: Reduction of species-specific CPUE for species presented here, with the exception of opakapaka, to less than half of their early values would suggest a yellow light situation for all of these species, especially ehu and onaga. Caution must be used in this interpretation because factors such as targeting of effort to specific species is not taken into account (see next section for targeted effort).

Comments: All CPUE time series remain highly variable. All 1999 partial CPUE values are well below their long-term averages. There are apparent declines in most species when comparing several years of recent values with values earlier in the time series. The decline is least apparent in opakapaka and most apparent in ehu. MHI trips are usually of one day duration.

Source: The partial CPUE for the MHI is based on HDAR C-3 catch report data from commercial fishermen.

Calculation & Adjustment: The same subset of HDAR data as used in Fig. 15-a is used here, but the weight of each species is tabulated separately rather than in aggregate. The same denominator value used in Fig. 15-a is used here (# trips fished), i.e. summing these five partial CPUE's (and remaining BMUS CPUE's) will approximate the Fig. 15-a estimates. 95% non-parametric confidence intervals were calculated by bootstrapping.

Figure 15-c. Partial targeted CPUE for MHI bottomfish

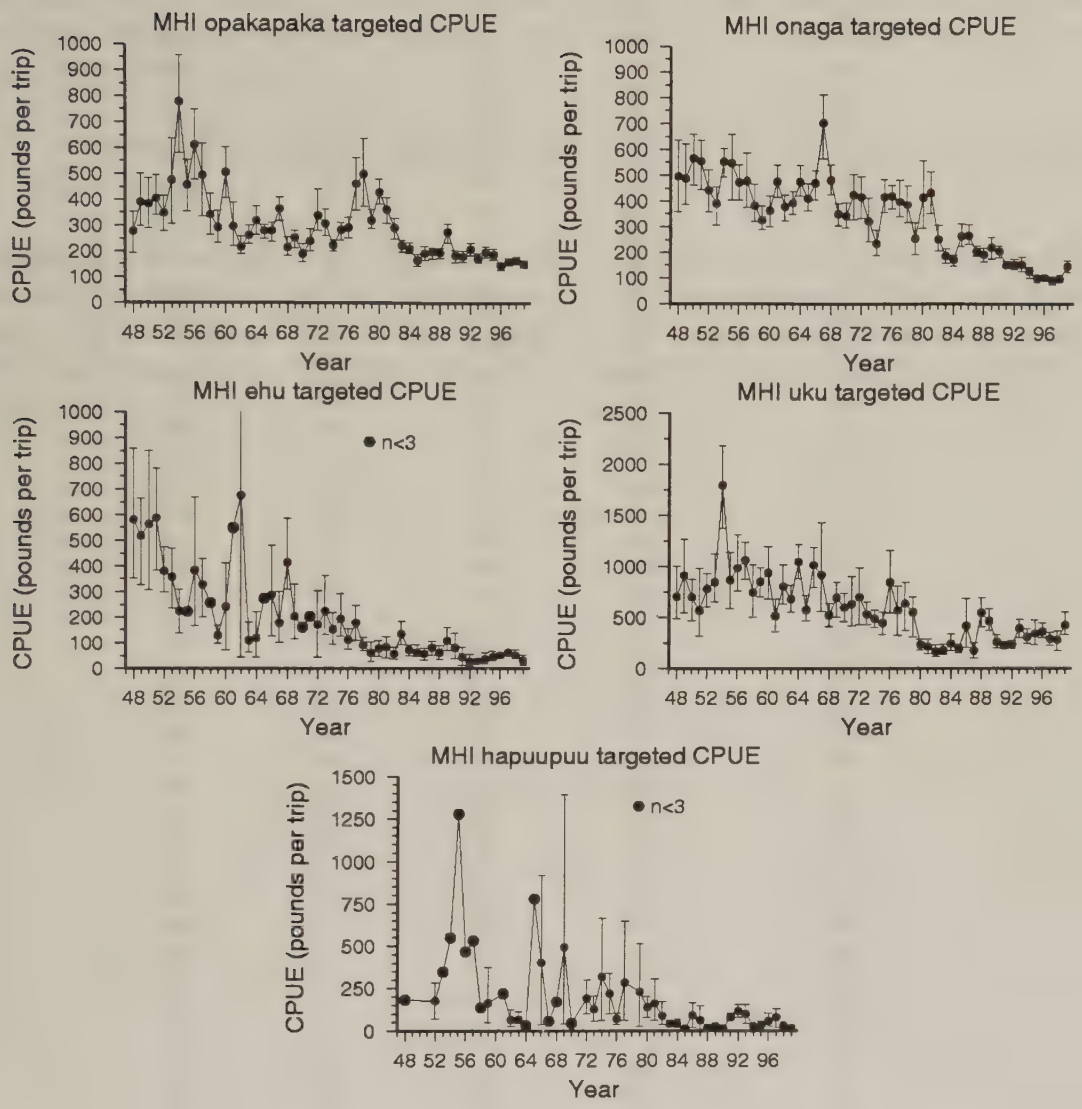


Figure 15-c data summary:

	MHI Targeted CPUE (lb/Trip)			
Year	Opakapaka	Onaga	Ehu	Uku
1948	277	496	581	705
1949	391	488	517	913
1950	385	566	564	701
1951	406	554	589	567
1952	348	442	380	779
1953	476	390	358	850
1954	779	552	224	1796
1955	458	547	222	869
1956	613	473	384	988
1957	496	479	327	1061
1958	344	382	257	745
1959	293	325	130	852
1960	507	364	242	939
1961	297	476	550	514
1962	216	379	677	806
1963	263	394	111	683
1964	320	475	120	1046
1965	281	411	275	574
1966	280	472	288	1014
1967	366	706	180	919
1968	215	484	415	525
1969	254	353	203	696
1970	191	345	161	600
1971	241	428	205	634
1972	339	420	171	699
1973	309	324	226	531
1974	225	236	152	488
1975	284	419	194	448
1976	293	421	112	846
1977	462	400	178	573
1978	501	389	92	640
1979	323	255	61	552
1980	430	415	79	235
1981	364	433	83	212
1982	293	252	58	164
1983	225	186	135	179
1984	212	173	72	241
1985	168	266	63	193
1986	194	267	58	418
1987	199	206	82	175
1988	198	192	60	549
1989	278	221	109	468
1990	187	205	82	260
1991	183	153	45	224
1992	212	154	27	238
1993	176	155	28	393
1994	200	125	37	311
1995	191	100	45	343
1996	147	103	51	363
1997	162	89	61	292
1998	166	98	52	283
1999	**152**	**146**	**31**	**422**
mean	303.27	342.00	200.08	586.85
s.d.	127.62	149.02	171.88	312.33

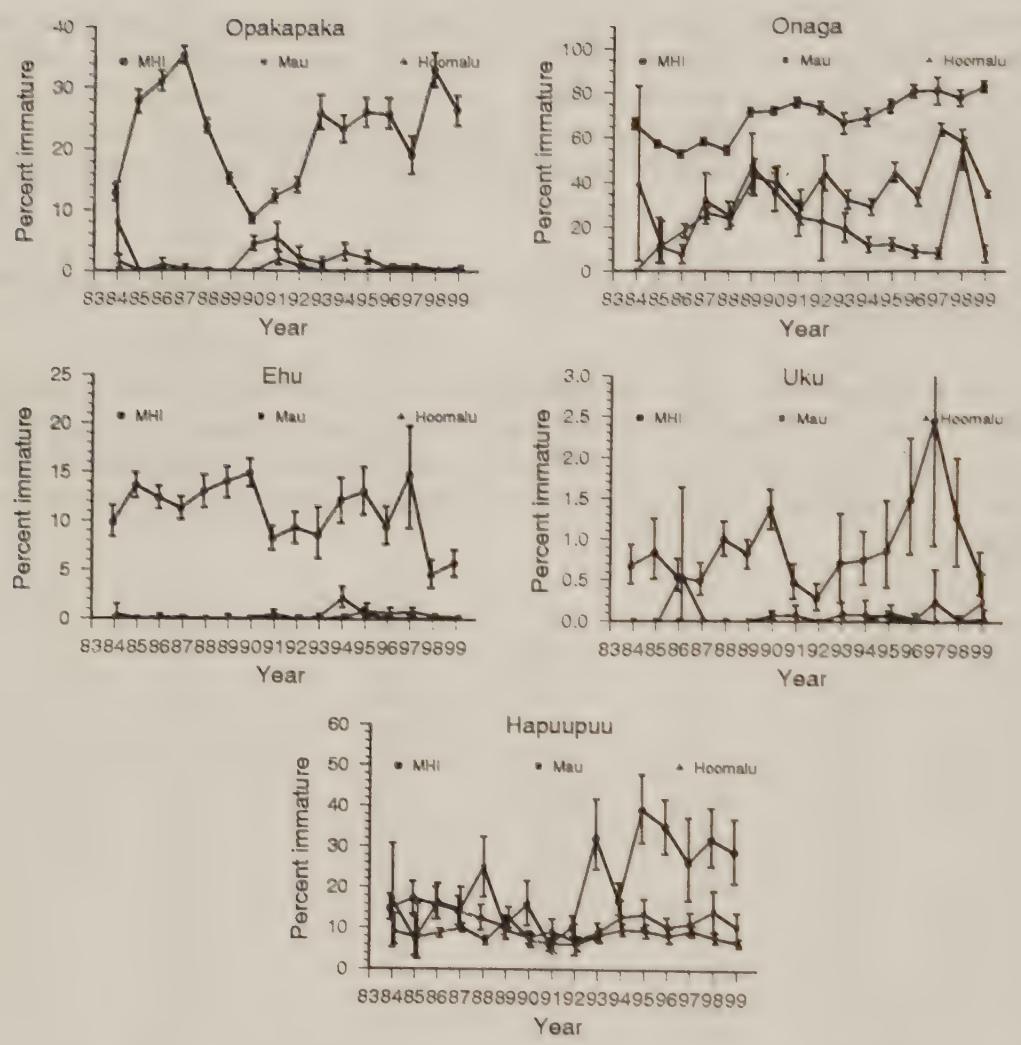
Interpretation: Comparison of CPUE values of the last 10 years (1990-99) with the first 10 years available (1948-57) indicate that all four species for which sufficient data is available have CPUE values less than 50% of original values (and their long-term averages, as well). These values represent a yellow light condition for these four species, with the ehu stocks being the most stressed.

Comments: As in Fig. 15-B, there are apparent declines when comparing several recent years with values earlier in the time series. The decline is least apparent in opakapaka and most apparent for ehu. The level of screening done here severely reduces the size of the sample, and this may contribute to some of the observed variability, particularly for ehu where there are fewer targeted trips. Values for hapuupuu are graphed but not put in the table due to the small numbers of targeted trips in most years.

Source: The partial targeted MHI CPUE is based on HDAR C-3 catch report data from commercial fishermen.

Calculation & Adjustment: The data used in Fig. 15-A were further screened to only include trips where at least 50% of the total catch by weight is the target species. This can only be done for species that are targeted successfully; incidental catch species will not contribute significantly enough to the overall catch. 95% non-parametric confidence intervals were calculated by bootstrapping.

Figure 16. Percent immature in Hawaiian bottomfish catch



Interpretation: MHI onaga catch has the highest percentage of immature fish, and is the only one consistently over 50%. In 1999 the MHI had onaga landings with over 50% immature fish, signifying a yellow light condition for this zone. In the NWHI zones onaga showed high % immature values for 1997 and 1998 in the Hoomalu zone and 1998 in the Mau zone. 1999 values, however, dropped below 50% for both zones. All other MHI and NWHI stocks are in the healthy range for percentage of immature fish in the catch.

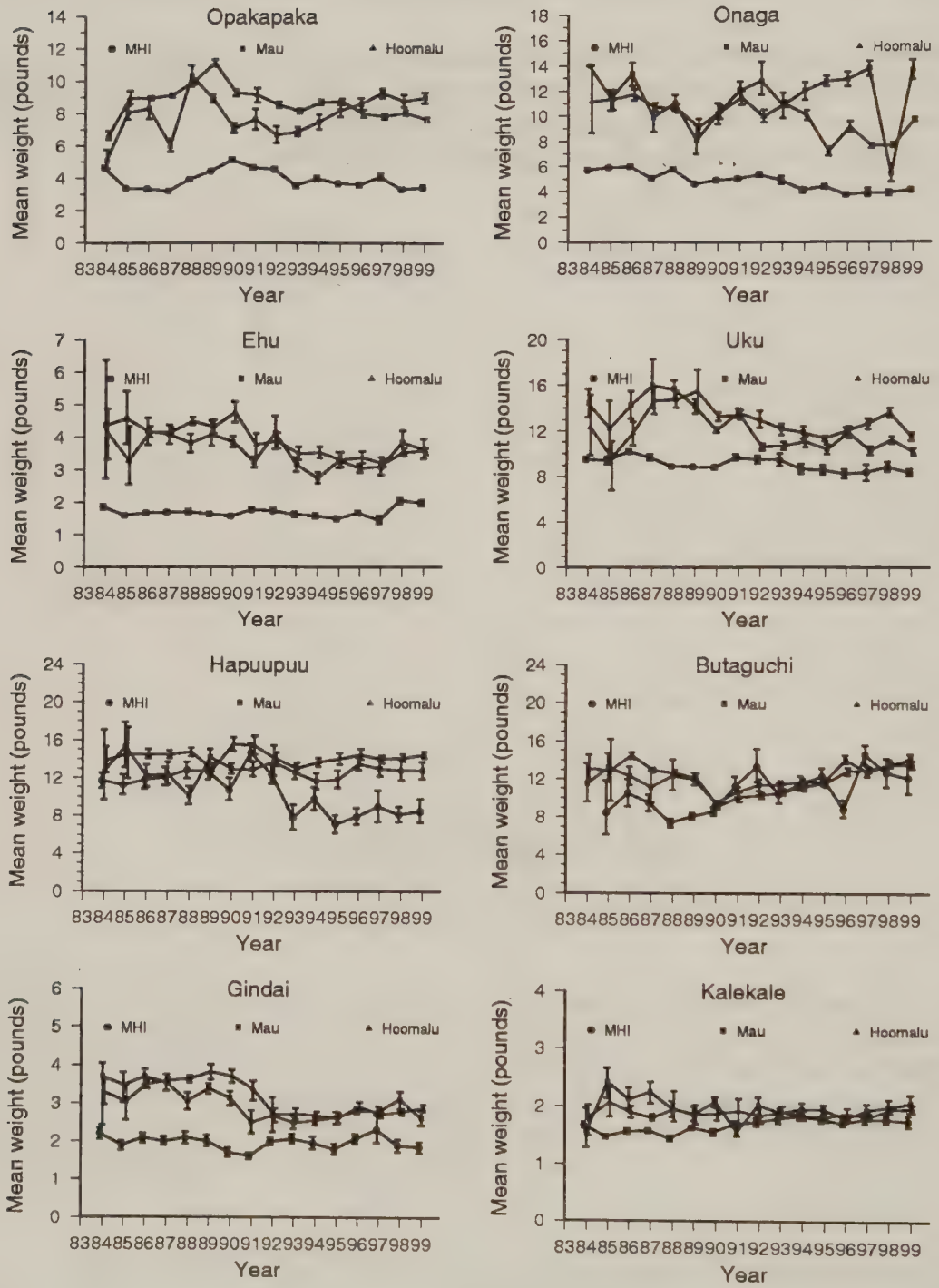
Comments: MHI catch is comprised of more immature fish than NWHI catch for all species. In all areas onaga values are the highest on average. Percent immature for uku are the lowest (i.e. healthiest) values in all zones. Among the other species, MHI opakapaka experienced

periods of relatively high values (peaking in the years 1985-87) and a sharp rise in 1998. MHI hapuupuu percent immature declined from a peak in 1995 to moderate levels in 1997-99.

Source: Fish size data is derived from auction lot statistics obtained at the Honolulu UFA auction by HDAR, NMFS and WPRFMC personnel. Size at maturity from Everson (1984), Everson (1990 unpub. rep.), Everson et al. (1989), Kikkawa (1984), Sudekum et al. (1991).

Calculation & Adjustment: The percent immature is calculated in terms of weight. The size distribution of sold fish is assumed to be representative of all fish caught. Maturity was assumed to be "knife-edge", and all fish in the same sales lot were assumed to be of equal size. 95% non-parametric confidence intervals were calculated by bootstrapping.

Figure 17. Mean weight of Hawaiian bottomfish



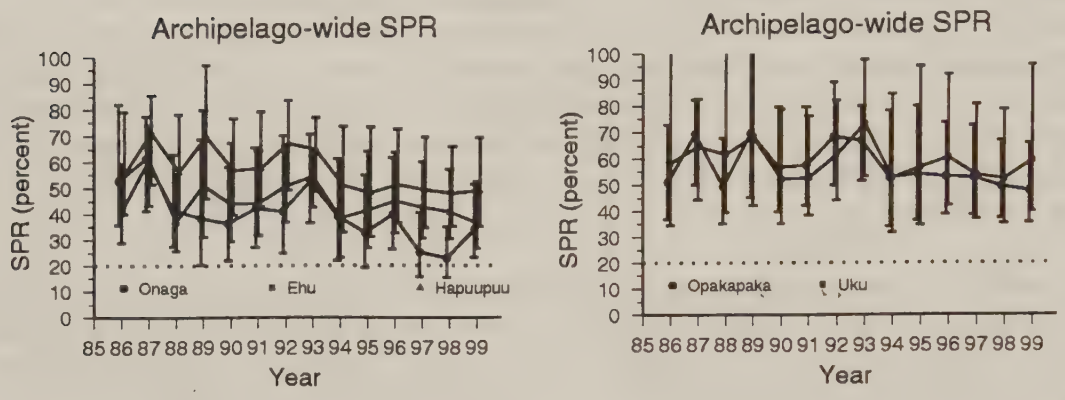
Interpretation: MHI mean weights are considerable lower than NWHI weights indicating considerable stress on these resources. No noticeable trends can be seen in NWHI mean weights, indicating relative health in these zones. Low mean weights were first recorded for MHI hapuupuu in 1993 and have remained low through the present. The small number of fish upon which the annual estimates are based may bias the result. However, with so many years in a row recording low mean weights, it is likely that marketed fish size has actually declined for MHI hapuupuu. Such a decline in mean size indicates increased stress on the MHI hapuupuu resource. These values do not exhibit a continuing decline, in fact, the 1997-99 values are slightly greater than the 1995 lowest value.

Comments: Mean weights of fish in the NWHI catch appear generally stable over time, with the notable exception of the onaga mean weight, where recent declines can be seen for both the Mau and the Hoomalu zone. The 1998 Mau onaga value is the lowest on record showing a sharp decline from earlier values with a return to normal levels in 1999. Apparently, this was a one year only phenomenon. MHI values have been remarkably stable for most species over the time series available, with continuously decreasing sizes found only in the MHI onaga and this decline is very gradual. MHI hapuupuu mean weight has relatively stable after a drop in mean size starting in 1993. The two most important changes in 1999 are the return in mean size of the Mau zone onaga and a second year of increased size in the MHI ehu.

Source: Fish size data is derived from auction lot statistics obtained at the Honolulu UFA auction by HDAR, NMFS, and WPRFMC personnel.

Calculation & Adjustment: The size distribution of sold fish is assumed to be representative of all fish caught. All fish in the same sales lot were assumed to be of equal size.

Figure 18. Archipelago-wide Spawning potential ratio (SPR)



Archipelago-wide SPR:

			SPR (%)		
Year	**Ehu**	**Hapuupuu**	**Onaga**	**Opakapaka**	**Uku**
1986	41	55	53	51	58
1987	61	71	61	69	65
1988	37	56	42	49	62
1989	51	70	38	69	68
1990	44	57	36	57	52
1991	44	58	42	57	53
1992	51	67	41	68	61
1993	54	65	53	67	73
1994	38	51	39	53	52
1995	41	48	33	54	56
1996	45	51	40	53	60
1997	42	49	25	53	54
1998	41	48	23	49	52
1999	**36**	**49**	**34**	**47**	**59**
mean	44.71	56.79	40.00	56.86	58.93
s.d.	7.13	8.30	10.41	7.99	6.47

Interpretation: SPR values for the five major BMUS species are all above the 20% critical threshold level when viewed on an archipelago-wide basis. Of these species, onaga usually has the lowest value with the 1999 value at 34%. This low value for onaga is due to the consistently poor condition of the resources in the MHI. Now that the state management plan for the MHI bottomfish has been implemented, it is likely that the condition of onaga resources in this area will improve and the archipelago-wide SPR value will increase over time.

The archipelago-wide SPR estimates are the best method available to assess the Hawaii bottomfish resources and should be the only values used to evaluate overfishing. SPR values are also presented in this document on a management zone basis for the purpose of determining locally depleted resources. It is the best policy to have all zones in a healthy condition and actions should continue to be implemented to assure the achievement of this goal. For the purpose of determining an overfished resource, however, the archipelago-wide condition is what should be measured. Evidence from larval drift simulation and preliminary genetic work point to

as single archipelago-wide stock with substantial larval transfer between zones (generally from the more healthy northwestern zones toward the more depleted MHI zone).

Comments: SPR values for all species fluctuate annually and have wide error bars. There are no particularly obvious trends in SPR values over the 12 year period of data. The only species showing current signs of concern is the onaga for which the lower bound is below the 20% critical threshold value. The management measures implemented by the state for the MHI should bring improvement of the MHI onaga resource over a period of a few years. Any improvements to the MHI resources will contribute to improvement of the archipelago-wide condition as well.

Source: Data used in calculating archipelago-wide SPR is derived largely from HDAR C3 commercial catch records integrated with NMFS interview data. Also important is the size frequency data obtained from market sampling by HDAR and NMFS. The final component is the weighting factor for each management zone, which is based on the percentage of total 100 fathom contour contained in each zone.

Calculation & Adjustment: Calculations use similar methodology as presented in Somerton and Kobayashi (1990) for dynamic SPR. Preweighted SPR values (point estimates and upper and lower bounds) are from the area specific estimates found in the following section (Figure 19, 19a, b, and c). NWHI estimates are calculated using area specific maturity estimates and partial CPUE values (where area specific landings of each species are divided by the total effort expended in the management zone). For the MHI, hapuupuu SPR estimates are calculated similarly to those for NWHI fish. For the remaining MHI species, however, targeted trips are identified and the landings and effort for these targeted trips only are used to calculate CPUE for these species. Weighting factors are applied to point estimate and upper and lower bounds for each species and management zone. Archipelago-wide values are derived by adding the zone specific components. The weighting factors are: MHI = 0.447, Mau zone = 0.124, Hoomalu zone = 0.429. Additionally, MHI values are weighted by model predicted increases in abundance due to State closed areas (12.4% increase for 1999).

Figure 19. Spawning potential ratio (SPR) for MHI bottomfish

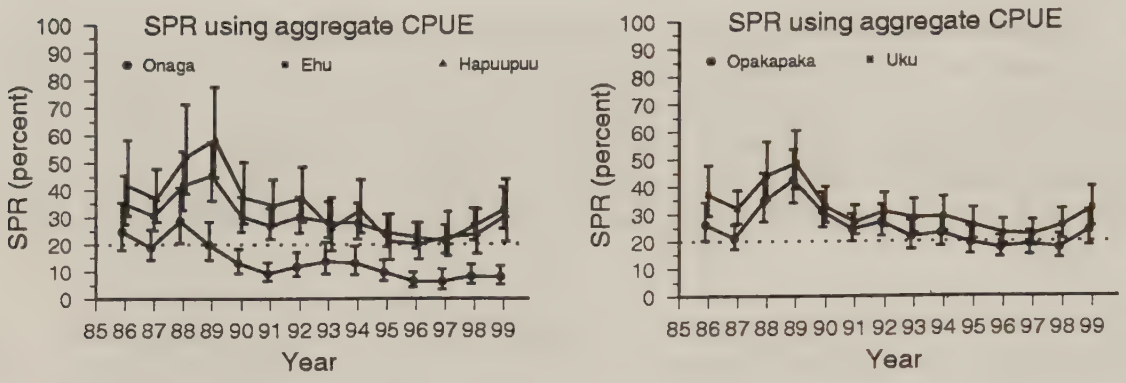


Figure 19 data summary:

			SPR (%)		
Year	**Ehu**	**Hapuupuu**	**Onaga**	**Opakapaka**	**Uku**
1986	35	42	25	26	37
1987	31	37	19	21	32
1988	42	52	29	35	44
1989	45	58	20	42	48
1990	30	37	13	31	33
1991	27	34	9	24	27
1992	30	37	12	27	31
1993	28	26	14	22	29
1994	28	33	13	23	29
1995	24	21	10	20	26
1996	23	20	6	18	23
1997	20	22	6	18	22
1998	27	25	9	19	26
1999	**32**	**30**	**8**	**24**	**32**
mean	30.14	33.86	13.79	25.00	31.36
s.d.	6.85	11.31	7.03	6.91	7.43

Interpretation: The peak SPR values observed in 1988-1989 for all species were largely a response to increases in aggregate CPUE due to increased uku landings and catch rates. 1999 SPR values show improvements over critically low values for all five major BMUS species in 1997. The improvement is largely due to an increase in aggregate CPUE over the low 1997 value. The 1999 value presented here for MHI hapuupuu is the best estimate of MHI SPR available, because we cannot calculate an SPR for this species using targeted CPUE. For the remaining species, the next section (Figure 19-A) gives the best estimation of 1999 MHI SPR.

Comments: Current SPR estimates for onaga in the MHI is below the twenty percent critical threshold level indicating localized resource depletion. Onaga remains below 20% for the tenth year in a row. The 1999 SPR value for MHI ehu rose again due to an increase in aggregate CPUE and mean fish size. The MHI hapuupuu SPR rose to 30% in 1999 from a low of 20% in 1996.

Source: SPR estimated from the Honolulu UFA auction size frequency data collected by HDAR, NMFS, and WPRFMC personnel; CPUE estimates from C-3 form data reported to HDAR by commercial fishermen. Additional information for opakapaka obtained from size frequency data of fish caught from the R/V Townsend Cromwell.

Calculation & Adjustment: Calculations use similar methodology as presented in Somerton and Kobayashi (1990) for dynamic SPR. Virgin CPUE estimate is 1948-1952 mean; current CPUE estimate is a single year estimate. CPUE is of aggregate bottomfish from the areas of Maui, Lanai, Molokai, and Penguin Banks (see Fig. 15-A for more details). Virgin catch size composition is estimated from the 1986-1988 NWHI catch data, and current catch size composition is estimated from single year MHI catch data. Values are weighted by the model predicted benefits of the State 20% closed areas. The 1999 weighting factor is 12.4%. All SPR values may have changed slightly from previous year's reports due to more complete reporting and improvements in the calculations. The 90.25% non-parametric confidence intervals were constructed based on "best" and "worst" case bounds of SPR components (CPUE and percent immature).

Figure 19-a. Spawning potential ratio (SPR) for MHI bottomfish using targeted CPUE

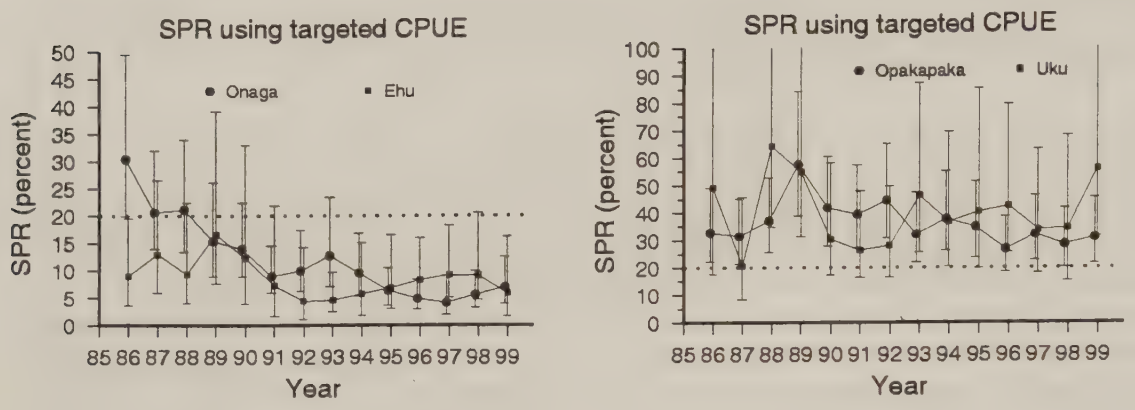


Figure 19a data summary:

	SPR (%)			
Year	**Opakapaka**	**Onaga**	**Ehu**	**Uku**
1986	32.71	30.37	8.99	49.11
1987	31.43	20.60	12.91	20.57
1988	36.88	21.03	9.30	64.24
1989	57.60	15.31	16.54	54.86
1990	41.73	13.86	12.32	30.29
1991	39.18	8.99	7.23	26.37
1992	44.41	9.95	4.37	28.01
1993	31.93	12.65	4.56	46.13
1994	37.48	9.49	5.76	36.51
1995	34.59	6.34	6.85	40.17
1996	26.96	4.81	8.16	41.15
1997	32.00	4.11	9.16	33.69
1998	28.36	5.48	9.09	34.36
1999	**30.84**	**6.93**	**5.81**	**55.72**
mean	36.15	12.14	8.65	40.08
s.d.	7.92	7.55	3.42	12.60

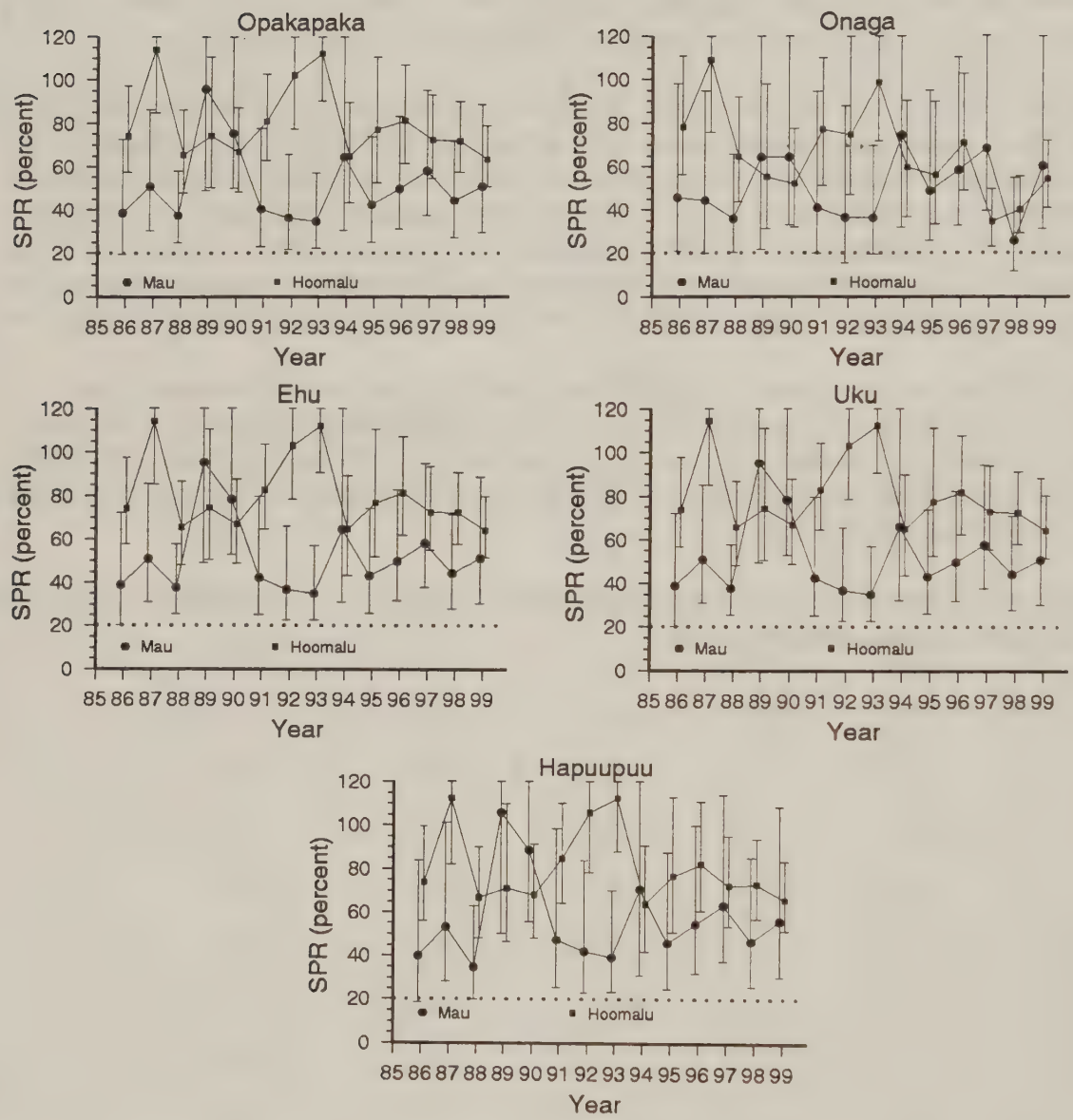
Interpretation: We feel that SPR values obtained here may better represent the condition of the MHI resources in regards to localized depletion than those found in the previous section. Ehu and onaga stocks are clearly stressed and well below the 20% SPR threshold, with ehu below the 20% level for the duration of our data and onaga on a continuing downward trend with values below 20% for the last10 years. Of particular concern is the continued decline in onaga SPR values; ehu values, though low, have not changed much over the years. Contrary to the results obtained in the previous section, opakapaka and uku SPR levels have remained above the 20% mark for all years sampled and do not indicate critical locally depleted conditions.

Comments: This is the fourth year that SPR values have been calculated using targeted CPUE values. These values are available for only four of the BMUS species present in the MHI. As expected onaga and ehu values are below the 0.20 critical level and have been for many years. SPR values for each of these two species are lower using targeted CPUE than they are using aggregate CPUE. Opakapaka SPR values are higher using targeted CPUE compared to using aggregate CPUE. For uku the high 1999 SPR value is due to unusually high catch rates. The low ehu 1999 SPR value is based on targeted catch rates from a very low number of trips (low n).

Source: SPR values are estimated using the Honolulu UFA auction size frequency data collected by HDAR, NMFS, and WPRFMC personnel; CPUE estimates from C-3 form data reported to HDAR by commercial fishermen and screened for trips targeting particular species. Additional information for opakapaka was obtained from size frequency data of fish caught from the R/V Townsend Cromwell.

Calculation & Adjustment: Calculations are conducted as in the previous section with targeted CPUE substituting for aggregate CPUE.

Figure 19-b. Spawning potential ratio (SPR) for NWHI bottomfish using targeted CPUE



Interpretation: The correlation of SPR values among species is due the high dependence of SPR on the CPUE component, given that the maturity component is nearly negligible. All species utilize the same aggregate bottomfish CPUE component. The maturity component is small relative to MHI SPR calculations because 1) the NWHI catch is primarily mature fish, and 2) the current catch size composition is relatively unchanged from the best estimate of the virgin catch size composition.

Figure 19b data summary:

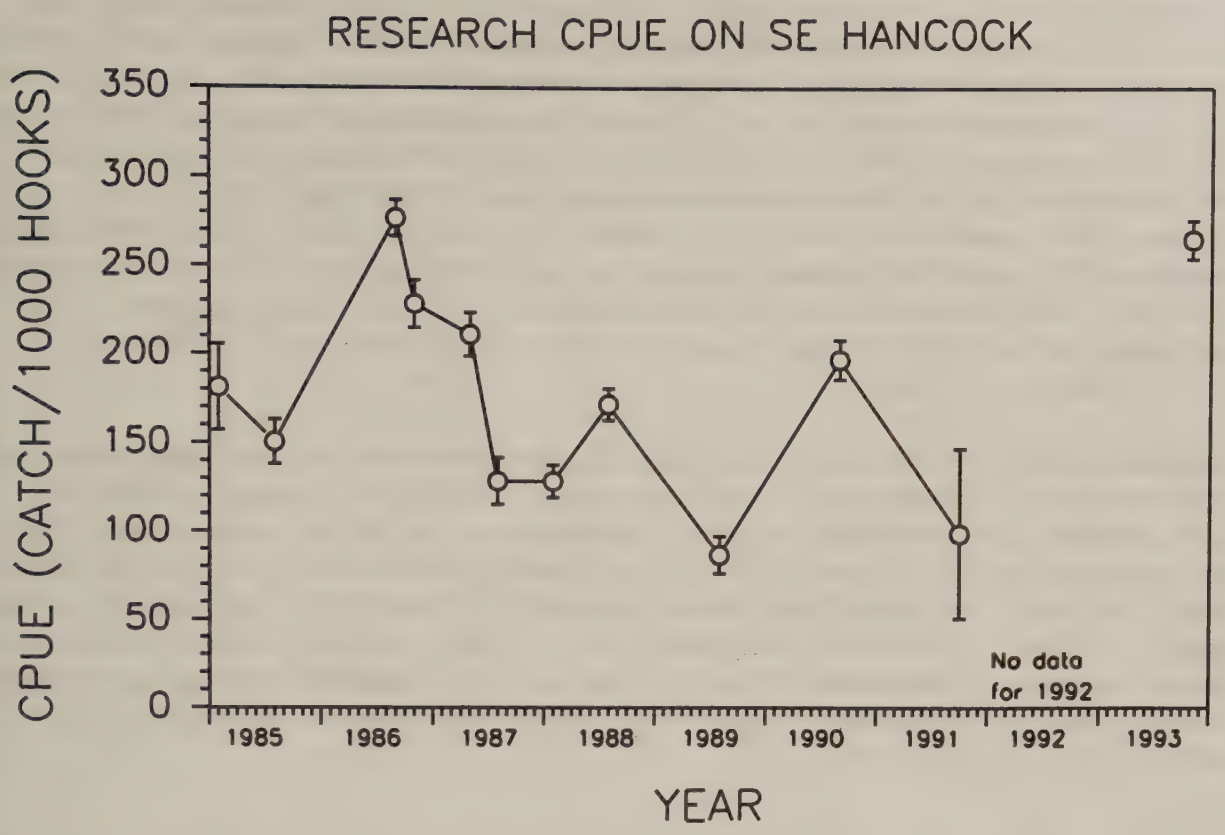
SPR (%)					
Mau Zone					
Year	**Ehu**	**Hapuupuu**	**Onaga**	**Opakapaka**	**Uku**
1986	39	40	46	39	39
1987	51	53	44	51	51
1988	38	35	36	38	38
1989	95	106	64	96	95
1990	78	89	64	75	78
1991	42	47	41	40	42
1992	37	42	36	36	37
1993	35	39	36	35	35
1994	65	71	75	64	66
1995	43	46	49	43	43
1996	50	55	58	50	50
1997	58	63	68	58	58
1998	44	47	26	44	44
1999	**51**	**56**	**60**	**51**	**51**
mean	51.86	56.36	50.21	51.43	51.93
s.d.	17.23	20.22	14.68	17.20	17.29
Hoomalu Zone					
1986	74	74	78	74	74
1987	114	112	109	114	114
1988	66	67	65	66	66
1989	74	71	55	74	74
1990	67	68	52	67	67
1991	83	85	77	81	83
1992	103	106	75	102	103
1993	112	112	99	112	112
1994	65	64	60	65	65
1995	77	77	56	77	77
1996	81	82	67	81	81
1997	73	73	35	72	78
1998	72	73	40	72	73
1999	**64**	**66**	**54**	**64**	**64**
mean	80.36	80.71	65.86	80.07	80.79
s.d.	17.00	16.95	20.61	16.92	16.85

Comments: Current SPR estimates for all five species in both zones are above the 20% critical threshold level indicating healthy resources on a local scale, though lower confidence limits often are near or slightly below this level. Mau Zone SPR estimates tend to be lower than Hoomalu Zone SPR estimates for most species, and onaga SPR estimates tend to be slightly lower than those for most other species in most years. Notable increases in onaga SPR values for the Mau and Hoomalu zones are due to decreases in the percent of immature onaga in the catches of these zones.

Source: SPR estimated from Honolulu auction size frequency data collected by NMFS personnel, and CPUE estimates from C-3 form data reported to HDAR by commercial fishermen.

Calculation & Adjustment: Calculations use same methodology as presented in Somerton and Kobayashi (1990) for dynamic SPR. Virgin CPUE estimate is 1948-52 mean; current CPUE estimate is a single year estimate. CPUE is of aggregate bottomfish calculated separately for Mau and Hoomalu Zones. Virgin catch size composition is estimated from the 1986-88 NWHI catch data, and current catch size composition is estimated from single year catch data. All SPR values changed slightly from previous year's reports due to improvements in the calculations. 90.25% non-parametric confidence intervals were constructed based on "best" and "worst" case bounds of SPR components (CPUE and percent immature).

Figure 20. Armorhead Stock Assessment



Interpretation: The fluctuations in CPUE shown in Figure H-18 are apparently the result of episodic recruitment followed by high natural mortality. These peaks in CPUE correspond to years (1986 and 1990) where an appreciable proportion (at least one-third) of the armorhead population consisted of fat individuals (fatness index $\geq$0.26) considered new recruits to the seamount population. Fatness index is defined as body depth divided by fork length. Subsequent to recruitment individuals cease somatic growth and over the course of 3-4 years, survivors decline in fatness index and weight. Without subsequent recruitment to the population in suceeding years, the armorhead population as a whole would decline both in numbers (natural mortality) and in biomass (natural mortality and declining fatness index of survivors). The high 1993 CPUE is unusual, however, since fat individuals (new recruits) account for <15% of the 1993 population while leaner individuals (<0.23 in fatness index) form the bulk of the population. These results apparently indicate that the 1993 population is primarily derived from recruitment which occurred either in late 1991 or during 1992. Previous work indicates that little if any annual recruitment to SE Hancock Seamount occurs after the summer months (Humphreys et al. 1993; Fishery Bulletin, U.S. 91:455-463). Since the 1991 stock assessment survey coincided with the end of the summer season, the increase in CPUE at SE Hancock for 1993 is most likely due to good recruitment during 1992. The sharp increase in the 1992 CPUE among seamounts outside the U.S. EEZ implies that a high recruitment occurred (across all seamounts) in 1992.

Data Source: Figure 20 presents CPUE based on research longline catches at Southeast (SE) Hancock Seamount by NMFS, Honolulu personnel aboard NOAA ship R/V *Townsend Cromwell*. Vertical bars represent the 95% confidence intervals about the mean CPUE. The CPUE derived from the September 1991 stock assessment survey was computed using data from only the first 5 bottom longline sets as opposed to the standard 40 sets used on all other research surveys. The armorhead population at SE Hancock Seamount was not assessed in 1992 and post-1993 and therefore no current CPUE estimates are available. The last stock assessment survey for armorhead at SE Hancock Seamount was conducted in October 1993. Future NMFS armorhead stock assessment cruises to SE Hancock Seamount are unlikely. Henceforth, annual armorhead SPR values for Colahan Seamount (located outside the U.S. EEZ) will be provided to serve as a relative indicator of armorhead stock levels at the Hancock Seamounts (see explanation in Calculations & Adjustments subsection of ARMORHEAD SPAWNING POTENTIAL RATIO section).

Calculations and Adjustments: Fishing gear and sampling methods utilized during armorhead stock assessment surveys at SE Hancock Seamount are described in Somerton and Kikkawa (1992; Fishery Bulletin, U.S. 90:756-769). The seamount is divided into quadrants and effort is portioned equally among quadrants. Within each quadrant, effort is conducted over four depth strata (<265 meters (m), 265-300 m, 301-400 m, and 401-500 m). CPUE is calculated as a depth stratified average. Based on gear comparison studies of fishing droppers with and without hook timers conducted on the August 1990 survey, new coefficients accounting for the negative effects of hook timers were computed and applied to the catches obtained on all SE Hancock research surveys since 1985.

TABULATED VALUES:

MONTH/YEAR	ARMORHEAD CPUE
JAN 1985	181.28
JUN 1985	150.51
AUG 1986	276.80
OCT 1986	228.03
APR 1987	210.98
AUG 1987	128.73
JAN 1988	128.77
JUL 1988	172.14
JUL 1989	86.69
AUG 1990	197.08
SEP 1991	98.97
1992	(unknown)
OCT 1993	264.85
1994	(unknown)
1995	(unknown)
1996	(unknown)
1997	(unknown)
1998	(unknown)

Figure 21. Armorhead Spawning Potential Ratio

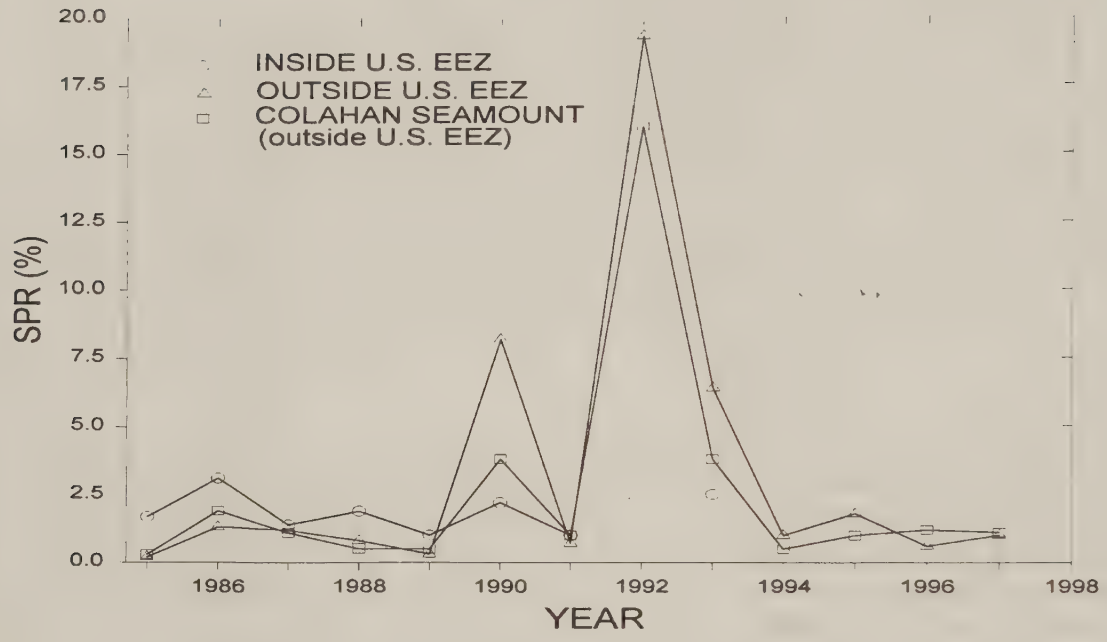
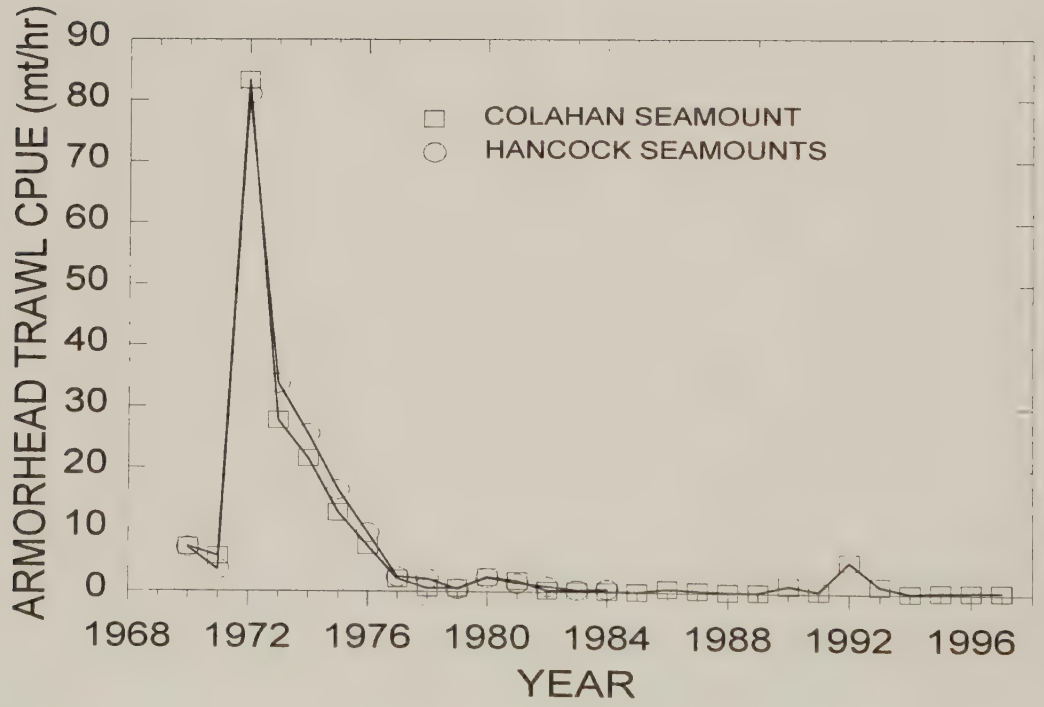


Figure 22. CPUE for Hancock and Colahan Seamounts



Interpretation: SPR within the region outside of the U.S. EEZ, which historically (Japan trawl fleet during the 1969-1981 period) contributed 91% of the total catch of armorhead, is 1.0%; based on the most current (1997) available catch and effort statistics from the Japan North Pacific trawl fishery. The 1996 SPR of 0.4% in last year's report was incorrect; the correct value (0.6%) however was only slightly higher. These low SPR values for the last two years of data indicate a continued depression in stock levels since the dramatic increase of SPR levels outside the U.S. EEZ in 1992 and the equally dramatic decline and continued low levels since then. This continuation of low stock levels outside the U.S. EEZ is interpreted to be a result of the intensive fishing effort on the high 1992 recruitment pulse coupled with little subsequent recruitment during 1993-1997 to compensate for losses due to fishing and natural mortality. Based on previous trends, catch levels are expected to remain low in 1998 unless offset by a large recruitment event.

Based on current estimates of a 2-2.5 year pelagic phase prior to seamount recruitment, the 1992 recruitment would have originated from the 1989-1990 winter spawning season. If this is correct, then the large 1992 recruitment originated from a parental stock which in 1989 had one of the lowest SPR values both inside and outside the U.S. EEZ (see table next page). This would appear to support the notion that dramatic increases in armorhead abundance across the seamounts are episodic and the product of environmental factors rather than simply a stock-recruitment relationship.

During February-March 1997, an oceanographic and larval armorhead survey over the seamounts outside the U.S. EEZ was conducted onboard the R/V *Kaiyo Maru* by the National Research Institute of Far Seas Fisheries Laboratory in Shimizu, Japan. Initial plans were to include research trawl hauls over Colahan Seamount, however, the ship was no longer equipped to conduct bottom trawl operations. Armorhead larvae were collected from surface waters around the Milwaukee Seamounts group, Colahan and C-H Seamount, but were absent from Koko Seamount. This same vessel conducted a research survey of pelagic stage armorhead in open ocean waters of the North Pacific during November 1998. The major objective was to tag-and-release pelagic specimens from various locations distant from the seamounts in hopes of later obtaining seamount re-captures and movement data. Unfortunately, no pelagic stages of armorhead were encountered during this cruise.

Management Issues: Effective September 1, 1998, the fishing moratorium on seamount groundfish at the Hancock Seamounts was extended for a third 6-year period until August 31, 2004. Based on current sustained low SPR values both at Colahan Seamount and at all SE-NHR seamounts outside the U.S. EEZ, it was inferred that the status of the Hancock Seamounts armorhead resource was similarly depressed. The intent of the moratorium is to provide continued long-term protection (which is absent elsewhere within the seamount habitat of the SE-NHR) to enhance the possibility of the armorhead resource to re-build via recruitment.

Data Source: SPR values for seamounts outside the U.S. EEZ are based on reported catch and effort data from the Japanese trawler fleet and values for seamounts within the U.S. EEZ (Hancock Seamounts) are based on research longline CPUE in addition to the trawl CPUE. However, with the cessation of research longline cruises to the Hancock Seamounts, SPR values

for Colahan Seamount (comparable in size and located closest to the Hancocks among seamounts outside the U.S. EEZ) are being provided now and in the future as an indicator of stock levels at the Hancock Seamounts. SPR values for Colahan Seamount are also based on reported catch and effort data at that seamount by the Japanese trawler fleet.

Calculations and Adjustments: SPR values outside the U.S. EEZ are computed as the current year CPUE divided by the average CPUE during the first three years of the fishery (1970-1972). SPR values inside the U.S. EEZ are computed as the estimated biomass on SE Hancock Seamount divided by the 1970-1972 average biomass. Biomasses are estimated using procedures described in Somerton and Kikkawa (1992). The SPR values for Colahan Seamount are computed as the current year CPUE divided by the average CPUE during the first three years of the fishery (1970-1972) at Colahan Seamount (Figure H-19). Fishery catch and effort data by seamount by month for seamounts outside the the U.S. EEZ have been provided annually since 1980 by colleagues at the National Research Institute for Far Seas Fisheries in Shimizu, Japan.

The decision to use SPR values for Colahan Seamount (instead of the overall outside U.S. EEZ values) as an indicator of armorhead stock conditions inside the U.S. EEZ (i.e., Hancock Seamounts) is based on the greater similarities between these seamounts. Aside from Colahan Seamount, the seamounts fished for armorhead outside the U.S. EEZ are Milwaukee Seamounts and Koko Seamount. These latter seamounts have summit areas of 67 and 564 nm^2 and average summit depths of 190 and 170 fm, respectively, while Colahan and the Hancock Seamounts have much smaller summit areas (about 1.4 nm^2) and shallower summit depths (141-150 fm). Fishing effort by the Japan trawl fleet has historically been
different at these two types of seamounts. Koko and Milwaukee Seamounts have always received the majority (about two-thirds) of the annual total trawling effort and were typically fished intensively over a sustained period of time. However, the fishing effort at Colahan and the Hancock Seamounts was applied in pulses since catch levels could not be sustained for more than several days without a "cooling off" period. These similarities plus the historical close coincidence between Colahan and Hancock Seamounts in temporal profiles of armorhead CPUE from the Japan trawl fleet (Figure H-20) indicate that SPR values for Colahan Seamount should provide the best future indicator of armorhead stock levels at the Hancock Seamounts.

TABULATED VALUES:

ARMORHEAD SPR (%)

YEAR	INSIDE US EEZ	COLAHAN	OUTSIDE US EEZ
1985	1.7	0.3	0.2
1986	3.1	1.9	1.3
1987	1.4	1.1	1.2
1988	1.9	0.5	0.8
1989	1.0	0.5	0.3
1990	2.2	3.8	8.2
1991	1.0	1.0	0.7
1992	NA	16.0	19.3
1993	2.5	3.8	6.4
1994	NA	0.5	1.0
1995	NA	1.0	1.8
1996	NA	1.2	0.6
1997	NA	1.1	1.0
1998	NA	NA	NA

Appendix 4

Commonwealth of the Northern Mariana Islands

CONTENTS

page

1. Introduction 4-2
2. Summary 4-3
3. Recommendations 4-4
4. List of Tables 4-5
5. List of Figures 4-5

Introduction

The Commonwealth of the Northern Mariana Islands (CNMI) bottomfish fishery occurs primarily around the islands and banks from Rota Island to Zealandia Bank north of Sariguan. However, this discussion will be limited to the catches landed on Saipan which is by far the largest market. The fishery will be characterized by data collected through the Commercial Purchase Data Base which indirectly records actual landings by recording all local fish sales to commercial establishments. This data collection system is dependent upon first-level purchasers of local fresh fish to accurately record all fish purchases by species categories on specially designed invoices. Division of Fish and Wildlife (DFW) staff routinely collect and distribute invoice books to 95 participating local fish purchasers; which include practically all fish markets, stores, restaurants, hotels, government agencies and roadside vendors (fish-mobiles). Although this data collection system has been in operation since the mid-1970s, only data collected since 1983 are considered accurate enough to be comparable for most aspects of the fishery.

The CNMI's bottom-fishery still consists primarily of small-scale local boats engaged in commercial and subsistence fishing, but in recent years larger vessels (35'-60') have entered the fishery. The bottom-fishery is broken down into two categories; deep (>500 ft) and shallow (100-500ft) water fishing. The deep water fishery is primarily commercial, targeting snappers and groupers. The snappers targeted include the Eteline and Pristipomoides complexes, whereas the eight-banded grouper (*Epinephelus octofasciatus*) is the only targeted grouper. The shallow water fishery, which targets the redgilled emperor (*Lethrinus rubrioperculatus*), is mostly commercial but also includes subsistence fishermen. Hand lines, home fabricated hand reels and electric reels are the common gear used for small-scale fishing operations, whereas electric reels and hydraulics are the common gear used for the larger operations in this fishery. Historically, some trips have lasted for more than a day, but currently, however, effort is defined and calculated on a daily trip basis. Fishing trips are generally restricted to daylight hours, with all vessels returning before or soon after sunset, unless fishing in the Northern Islands. In terms of participation the bottomfish fleet consists primarily of vessels less than 24 feet in length which are usually limited to a 30-mile radius from Saipan. The larger commercial vessels that are able to fish extended trips and which focus their effort from Esmeralda Bank to Zealandia Bank, have landed the majority of the bottomfish reported through the purchase receipt form. In 1999, one commercial venture dropped out (end of July) and another re-started operations (in June) after a year-long hiatus. Two more companies consisting of one and two vessels geared-up to begin bottomfishing in the Northern Islands. At the end of the calendar year they had not yet commenced operations. The company that re-started operations focused primarily on the red-gill emperor, although their fishing effort was sporadic. In addition to these larger vessels a 29' vessel began fishing at Malakis Reef (25 miles NNW of Saipan), plus at Opakapaka and FDM, although their effort north of Saipan was occasional.

Bottom-fishing requires more technical skill than pelagic trolling, including knowledge of the location of specific bathymetric features. Presently, bottom-fishing can still be described as "hit or miss" for most of the smaller size (14-25 ft.) vessels. Without fathometers and even nautical charts, the majority of fisherman utilizing smaller vessels often rely on land features for guidance to a fishing area. This type of fishing is inefficient and usually results in a lower catch per unit of effort (CPUE) in comparison with pelagic trolling. Larger sized (25 ft. and above) vessels typically utilize Global Positioning System (G.P.S.), fathometers and electric reels, resulting in a far more efficient operation.

Summary

From the consistently high increased landings documented from 1994-1999 it is apparent that bottomfishing activity in the CNMI continues to be greater than the decline experienced seven years ago. In 1999, bottomfish landings decreased by 3.1% from 1998, though exceeding the 1995 landings by 35%. Domestic US, joint-venture, and foreign vessels are still inquiring about full-time bottom-fishing throughout much of the CNMI. The impact to the commercial market is still unclear despite a fish market assessment study that was conducted in 1994, but only recently completed in late 1996. This study did not correspond with the significant increase in the Northern Islands bottomfish harvest.

The number of large vessel commercial bottomfishing ventures active in the Northern Islands maintained at one by the end of 1999, although a 29' vessel became active on some of the banks north of Saipan. It appears as though two new companies, totaling three large vessels, will attempt to enter the fishery in 2000. Commercial trips continue to be sampled on a monthly basis.

Revenues and prices will probably continue to increase with renewed fishing interest, larger financial investment, and increased utilization of modern electronics and equipment. Deep-water snappers still command the best prices. Fishermen utilizing larger vessels will have greater access to these deepwater resources, especially in the Northern Islands of the CNMI. Subsequently, the market demand should continue to increase as long as the supply of these fish increases with consistent quality. This industry could continue to expand with potential support by a training program in bottom fishing that addresses the following; proper fish handling, use of fathometers, nautical charts, modern electronic equipment such as GPS, fish finders, electric reels, plus anchoring techniques and marketing.

With the potential expansion of biological data collection from the bottom fishery, as well as DFW fishing surveys, an assessment with the aid of the National Marine Fisheries Service, should be completed for the bottomfish stocks surrounding Saipan, Tinian and Rota. After identifying the extent of resource utilization, additional data collecting could be used to help determine comprehensive management strategies. Continued sampling of vessels bottomfishing plus actual fishing by DFW in the Northern Islands of the CNMI will provide useful estimates of CPUE.

Recommendations

1) To request NMFS and the Council to assist DFW in adequately assessing the status of shallow and deep water bottomfish stocks in the southern islands of the CNMI.

2) Establish baseline (virgin stock) estimate for CPUE the Guam/Northern Marianas deep-water bottomfish complex (e.g., survey on grouper, snapper) utilizing data collected from the current fishery in the Northern Islands.

3) Establish baseline (virgin stock) estimate of CPUE for the Guam/Northern Marianas shallow-water bottomfish complex (e.g. redgilled emperor) by sampling program aboard DFW research vessel to help calculate SPR, with assistance from NMFS.

4) With assistance from NMFS/WPacFIN, software should be developed and implemented to separate fishery statistics for the main islands fishery and from the Northern Islands fishery with separate descriptions and statistics reported in the annual report module.

Tables

page

1. CNMI Consumer Price Indexes 4-6
2. CNMI 1999 commercial landings of bottomfish species 4-7

Figures

page

1. CNMI commercial bottomfish landings and revenue 4-8
2. Number of fishermen (boats) making bottomfish landings 4-10
3. Number of CNMI bottomfish trips 4-12
4. CNMI average price of bottomfish 4-14
5. CNMI average inflation adjusted revenue per trip landing bottomfish 4-15
6. CNMI bottomfish catch in average pounds per trip 4-17

Table 1. CNMI Consumer Price Indexes (CPIs)

Year	CPI	CPI Adjustment Factor
1983	140.90	1.88
1984	153.20	1.72
1985	159.30	1.66
1986	163.50	1.62
1987	170.70	1.55
1988	179.60	1.47
1989	190.20	1.39
1990	199.30	1.33
1991	215.00	1.23
1992	232.90	1.13
1993	243.17	1.09
1994	250.00	1.06
1995	254.47	1.04
1996	261.98	1.01
1997	265.00	1.00
1998	264.20	1.00

Calculation: The Commonwealth of the Northern Mariana Islands Consumer Price Index is computed by the NMI Department of Commerce using the Laspeyres' formula.

Table 2. CNMI 1999 commercial landings of bottomfish species

Species	Landings (lb)	Revenue ($)	Ave. Price ($/lb)
Unidentified Bottomfish	5603	15299	2.73
Jacks	1616	5409	3.35
Sickle Pomfret	.186	479	2.57
Ehu	657	2298	3.50
Gindai	2949	10259	3.48
Grouper	3121	9303	2.98
KaliKali	5	18	3.50
Onaga	13881	60137	4.33
Opakapaka	1418	4796	3.38
Lehi	7989	34042	4.26
Amberjack	275	953	3.47
Emperor(Mafute)	6717	18016	2.68
Subtotal	**44415**	**161007**	**3.63**

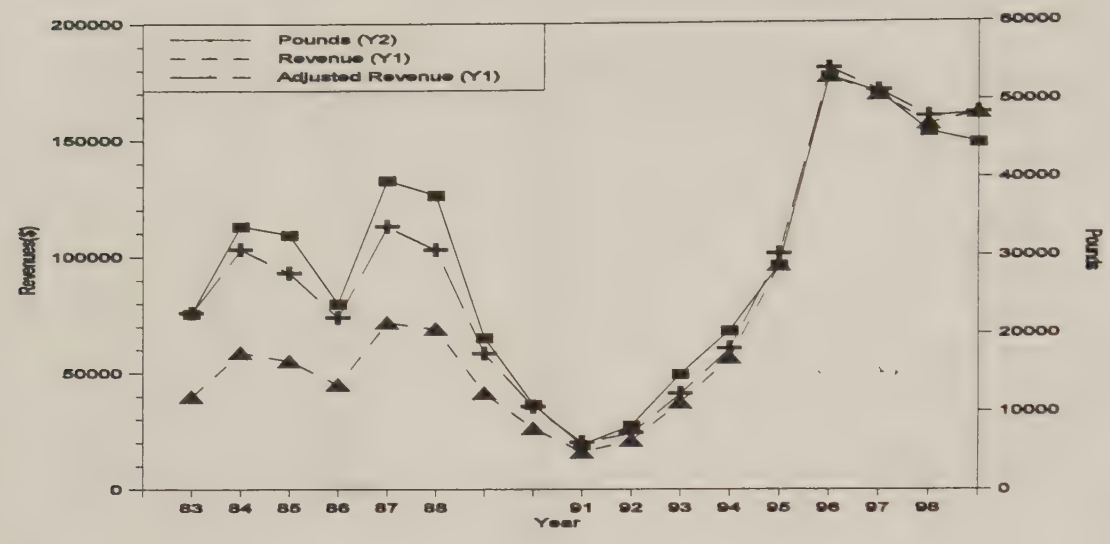
Interpretation: The percentage of bottomfish not identified to purchase receipt classification decreased 4.7% from 1998. This may be attributable to the switch in large vessels that occurred in 1999, where the company that submitted detailed breakdowns of catch on their invoices dropped out in 1999. They were then effectively replaced by an older company that did not fish in 1998 but that submits less detailed catch information on their invoice forms. Also, a 29' vessel entered the bottom fishery and became successful but did not submit detailed invoice records. A notable change from 1998 was the continued decrease in redgill emperor landings, which decreased 39% from 1998 (11,082 pounds), and 67% from the 1997 peak of 20,355 pounds. This decreased below the 1996 value of 9,592 pounds. This was due to an overall decrease in effort targeted at the redgill emperor in the Northern Islands in 1999, as the highliner that eventually dropped out of the fishery in 1999 did not target the redgill emperor as much as it had in the past. This species continued to be a seasonal favorite of smaller (25-30 foot) vessels harvesting around the island of Farallon de Mendinilla. The 'jacks' category continued to decrease, 14.6% from 1998. Landings of grouper decreased by 50% from 1998, while onaga increased 15%. Lehi (*Aphareus rutilans*) landings continued to increase to an all-time high of 7,989 pounds, or 39.6% over the previous all-time high landings in 1998. It was expressed by fishermen from the major Northern Islands venture that lehi were being caught instead of onaga in some locations.

Landings of gindai increased 64.8% from 1999. Landings of the opakapaka group decreased 35% from 1998.

Onaga continued to command the highest price per pound, followed by the silvermouth. The average bottomfish price has increased from %3.32 in 1997, to $3.41 in 1998, to 3.63 in 1999. Groups that decreased included the kaliali, opakapaka, emperor and unidentified bottomfish category. The kalikali price dropped from $4.26 to $3.50, although only five pounds were documented in the invoice records. The mean price per pound for bottomfish increased from 3.41 in 1998 to 3.63 in 1999.

Calculation: Annual summaries for each species from invoice data sheets.

Figure 1. 1999 CNMI commercial bottomfish landings and revenue.

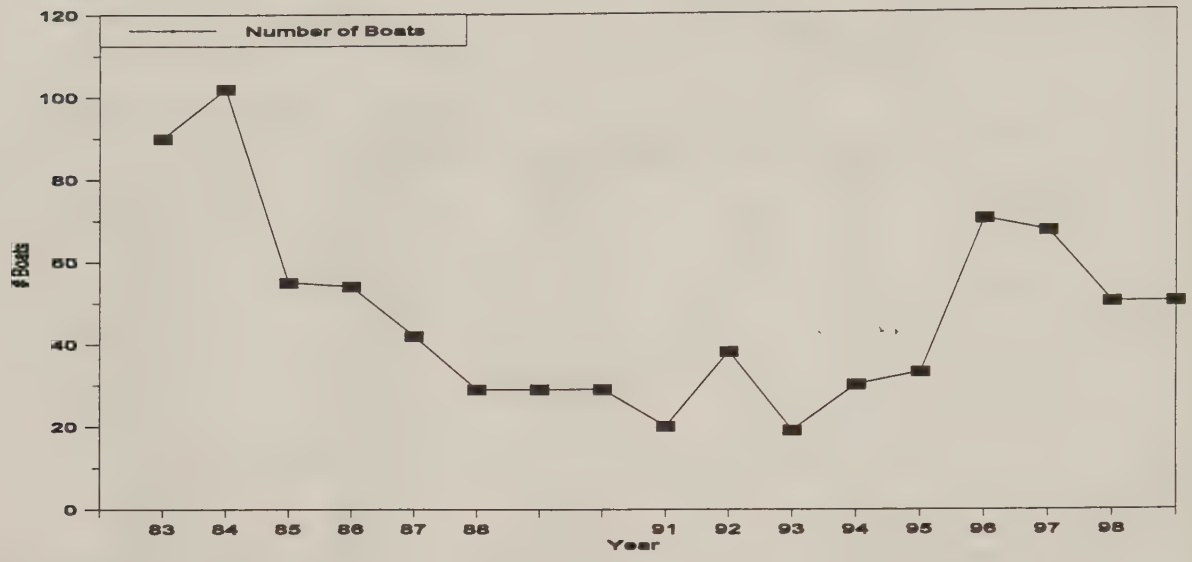


Interpretation: Landings, revenues and adjusted revenues for 1999 have remained relatively constant from 1998, with revenues increasing slightly over 1998, and landings decreasing slightly from 1998. This is attributed to the relative constant bottomfish effort concentrated in the Northern Islands. Bottomfish landings were high from 1984 through 1988 due to consistent fishing activity in the Northern Islands, centered around the island of Farallon de Medinilla. This fishery subsequently ceased by 1990, resulting in the steep drop in bottomfish landings in the early '90's due to a low number of bottomfish trips. In 1994 consistent fishing activity in the Northern Islands began once more and has continued to the present, resulting in a six-year annual mean of 40,529 pounds.

Calculation: Landings in pounds are from a simple data base summation of reported purchases of all bottomfish species combined. Revenue in dollars is from the same type of data base summation of the value field. The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 1999 CPI figure as the basis by which calculations of previous years' prices are made.

Year	Pounds	Unadjusted Revenue	Inflation-Adjusted Revenue
1983	22,683	40,003	76,006
1984	33,924	59,005	103,259
1985	32,780	55,396	93,065
1986	23,929	45,079	73,930
1987	39,772	71,868	112,833
1988	37,850	69,052	102,887
1989	19,550	41,379	58,344
1990	10,903	26,323	35,536
1991	5,693	16,118	20,148
1992	8,148	21,032	24,187
1993	14,769	37,310	41,041
1994	20,363	56,405	60,353
1995	28,744	96,100	100,905
1996	52,967	176,707	180,241
1997	50,851	168,890	170,579
1998	45,835	156,256	156,256
1999	**44,415**	**161,007**	**161,007**
Average	29,010	76,349	92,387
Standard Deviation	14,882	54,786	51,157

Figure 2. Number of Fishermen (boats) making bottomfish landings.



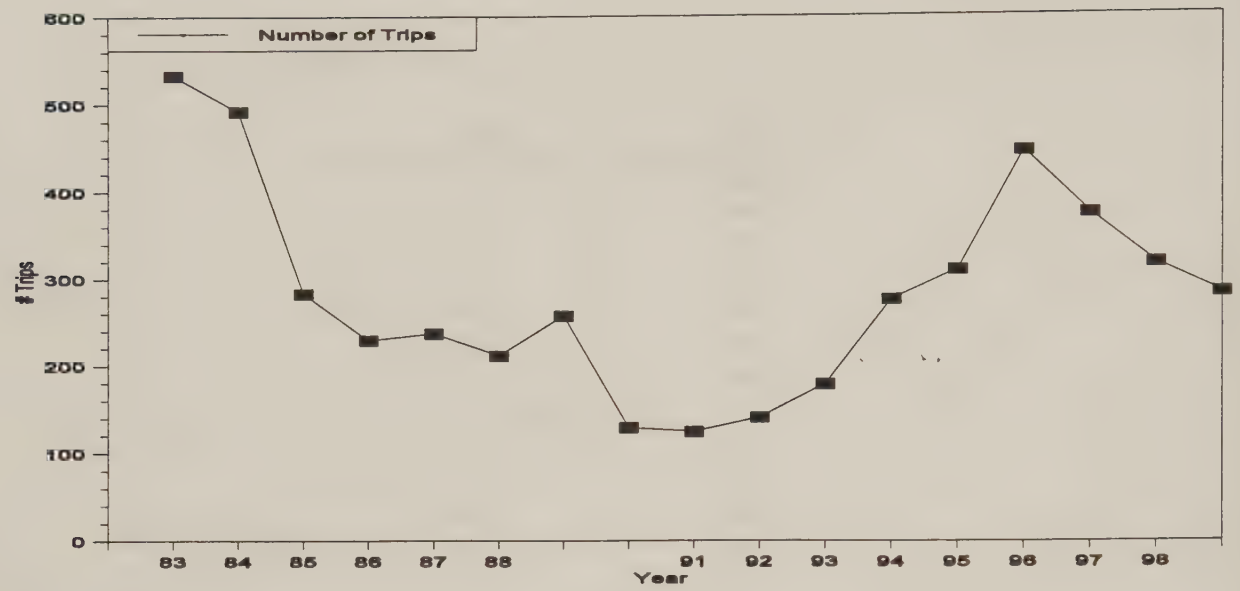
Interpretation: As with the number of trips (Fig. 3), the number of boats or fishermen making commercial landings of any bottomfish species declined from 1985 to 1988, stabilized between 1988-90, slightly increased during 1992, decreased again in 1993, then increased during 1994 and 1995, and increased 100% in 1996. The number of vessels making bottomfish trips remained the same from 1998, dropping to near the 16 year average.

More smaller vessels are landing 'mixed' trips over past years. That is smaller vessels are both trolling and bottom fishing on a single trip.

Calculation: The fisherman or boats selling the catch is identified on the "trip ticket" invoices used by purchasers. The plot shows the number of unique fishermen making any landings of bottomfish within a given year.

Year	Boats
1983	90
1984	102
1985	55
1986	54
1987	42
1988	29
1989	29
1990	29
1991	20
1992	38
1993	20
1994	32
1995	33
1996	70
1997	68
1998	50
1999	**50**
Average	48
Standard Deviation	24

Figure 3. Number of CNMI bottomfish trips.

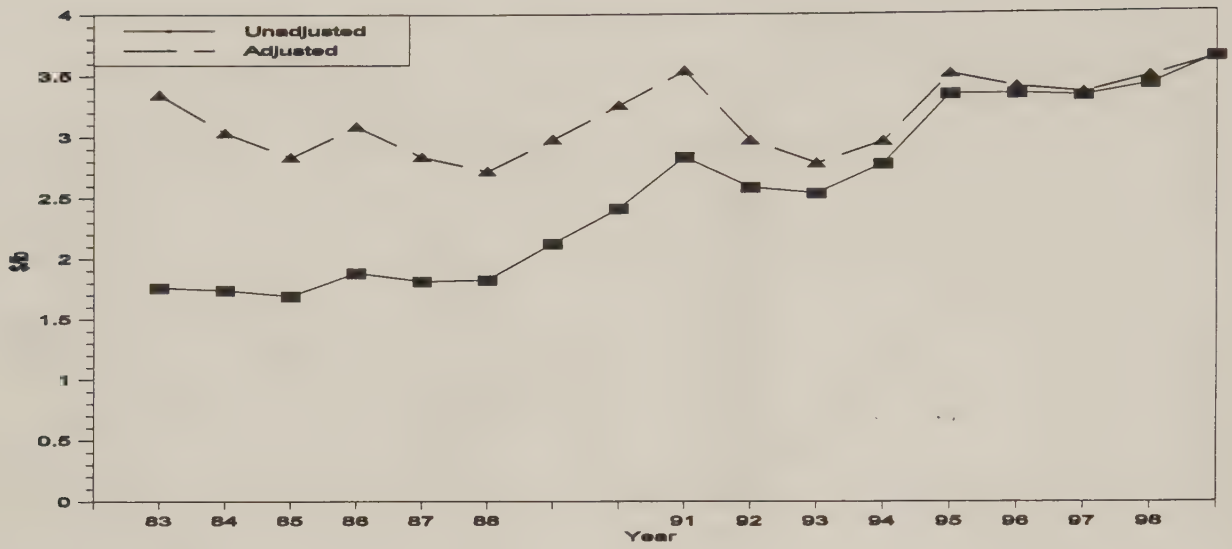


Interpretation: The number of bottomfish trips continued to decrease, by 10.7% from 1998, and 24% from 1997, although the number of fishermen making landings remained constant (Figure 2). The number of bottomfish trips was high from 1984 through 1988 due to consistent fishing activity in the Northern Islands, centered around the island of Farallon de Medinilla. This fishery subsequently ceased by 1990, resulting in the steep drop in bottomfish trips in the early '90's. In 1994 consistent fishing activity in the Northern Islands began once more and has continued to the present, resulting in a five-year annual mean of 334 trips.

Calculation: The number of trips which resulted in landing any bottomfish are tallied by adding each recorded fisherman's trip on a given day. This assumes that each fisherman lands only once in a given day, and that all of the catch is sold on that day. Most trips last a single day, but it is also known that the occurrence of longer fishing trips is increasing.

Year	Trips
1983	533
1984	492
1985	283
1986	229
1987	237
1988	211
1989	257
1990	129
1991	124
1992	140
1993	178
1994	275
1995	309
1996	445
1997	374
1998	317
1999	**283**
Average	283
Standard Deviation	121

Figure 4. CNMI average price of bottomfish.

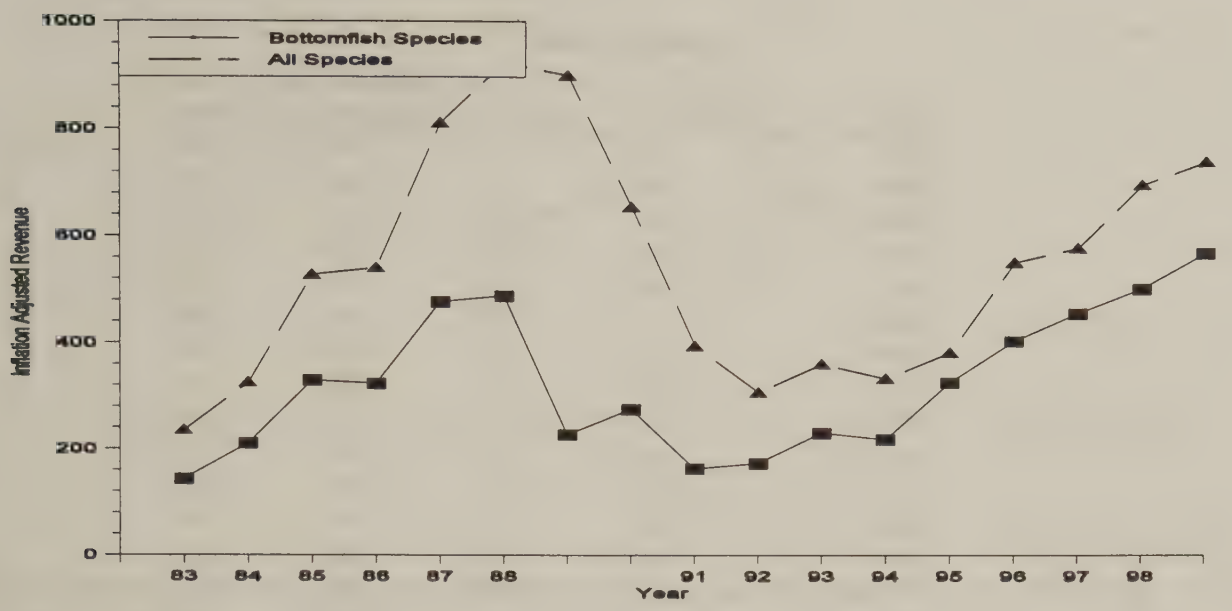


Interpretation: The average price increased steadily from 1988 to 1991, where it reached what was once a record high of $2.83. In 1995 the price increased to a new record high of $3.34. This unadjusted price remained constant through 1997, and increased to $3.41 in 1998, and has reached a new record high of $3.63 in 1999. The adjusted price continued to increase from 1997.

Calculation: The average price of the bottomfish complex is calculated by dividing the total revenue by the total landings. The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 1998 CPI figure as the basis by which calculations of previous years' prices are made. The CPIs for 1983-87 were not available from the appropriate CNMI agency and were, therefore, estimated by using Guam's annual inflation rate to proportionately adjust the 1988 CNMI CPI.

Year	Unadjusted $/lb	Adjusted $/lb
1983	1.76	3.32
1984	1.74	2.99
1985	1.69	2.81
1986	1.88	3.05
1987	1.81	2.80
1988	1.82	2.68
1989	2.12	2.94
1990	2.41	3.21
1991	2.83	3.48
1992	2.58	2.92
1993	2.53	2.75
1994	2.77	2.94
1995	3.34	3.48
1996	3.34	3.37
1997	3.32	3.32
1998	3.41	3.41
1999	**3.63**	**3.63**
Average	2.53	3.12
Standard deviation	0.69	0.30

Figure 5. CNMI average inflation adjusted revenue per trip landing bottomfish.

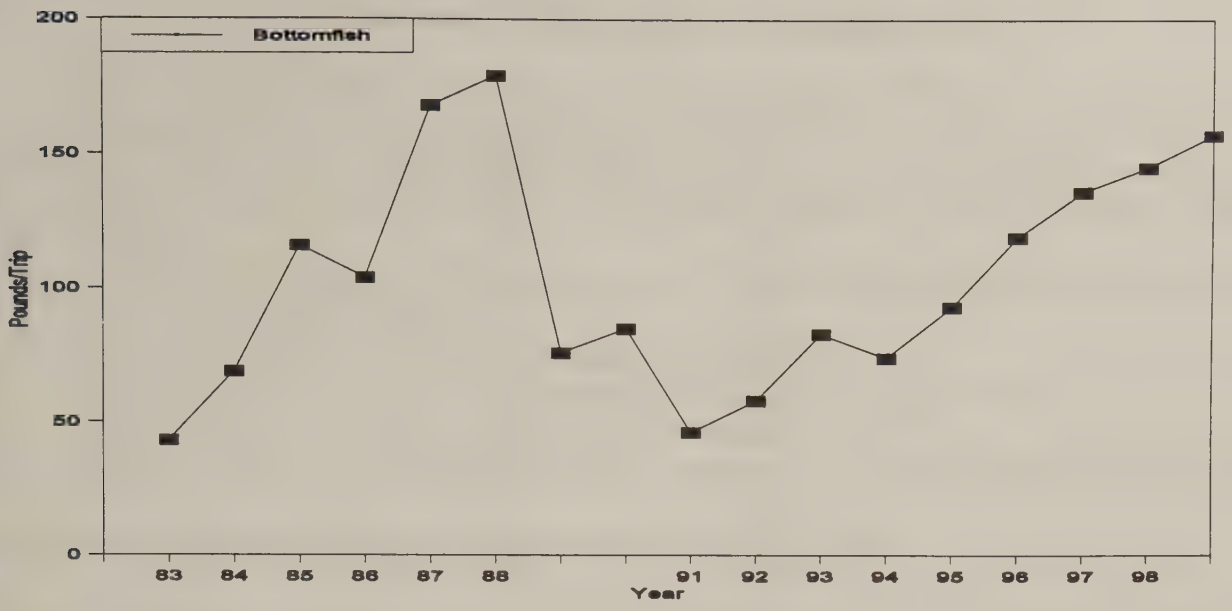


Interpretation: Inflation adjusted bottomfish revenue in 1999 increased over 1998, continuing a trend begun in 1994. The 'bottomfish species' inflation adjusted revenue increased 11.6% from 1998, and the 'all species' inflation adjusted revenue increased 5.7% from 1998. The bottomfish fishery has always been a small proportion of the total fisheries, but it appears that bottomfish continue to comprise a relatively higher percentage of the trip revenue on trips where bottomfish were caught.

Calculation: Only trips which landed bottomfish are included in these calculations. "Bottomfish $/Trip" is the total revenue of the bottomfish sold from a trip, and "All Species $/Trip" is the total trip revenue of all species combined (e.g. any pelagic and reef fish which were sold). The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 1998 CPI figure as the basis by which calculations of previous years' prices are made. The CPIs for 1983-87 were not available from the appropriate NMI agency and were, therefore, estimated by using Guam's annual inflation rate to proportionately adjust the 1988 NMI CPI.

	Bottomfish Species		All Species	
Year	**Unadjusted**	**Adjusted**	**Unadjusted**	**Adjusted**
1983	75	143	124	236
1984	120	210	186	326
1985	196	329	314	528
1986	197	323	330	541
1987	303	476	517	812
1988	327	487	621	925
1989	161	227	639	901
1990	204	275	485	655
1991	130	163	316	395
1992	150	173	268	308
1993	210	231	329	362
1994	205	219	313	335
1995	311	327	366	384
1996	397	405	542	553
1997	452	457	575	581
1998	493	503	685	699
1999	**569**	**569**	**741**	**741**
Average	246	305	413	527
Standard Deviation	122	122	169	213

Figure 6. CNMI bottomfish catch in average pounds per trip



Interpretation: The average pounds per trip of bottomfish increased 7.6% over 1998, and 13.4% over 1997, to the third highest level in the past 17 years. The substantial increase since the low in 1994 can be primarily attributed to the Northern Islands fishery, coincident with the increase in vessels making bottomfish trips, increased revenues, and annual landings during that six-year period.

Calculation: The average catch per trip is calculated by dividing the total weight of all bottomfish landings by the number of trips which landed bottomfish, regardless of the amount of bottomfish landed on any given trip. Although the average catch per trip is not a very good measure of CPUE, because it is subject to significant biases (e.g. changes in trip length and relative amounts of Bottom fishing compared to trolling), it is the only measure readily possible from the commercial landings system. It may be possible to improve this measure of CPUE by using only those trips which landed bottomfish exclusively, but that has not yet been accomplished.

Year	Pounds per Trip
1983	43
1984	69
1985	116
1986	104
1987	168
1988	179
1989	76
1990	85
1991	46
1992	58
1993	85
1994	74
1995	93
1996	119
1997	136
1998	145
1999	**157**
Average	103
Standard Deviation	42

Appendix 5. NMFS 1999 Administrative Activities

On February 18, 1999, the Secretary of Commerce approved FMP Amendment 5; the final rule implementing Amendment 5 became effective on May 28, 1999 (64 FR 22810, April 28, 1999). This action established a 10 permit-limited entry program for the NWHI Mau Zone bottomfish fishery, with two of the permits reserved for a Community Development Program. The following are details of the amendment.

- a point system for initial entry into the program is based on historic participation in the fishery;
- transfer of permits is prohibited;
- replacement vessels are limited to a length of 60 ft or less;
- a use-it-or-lose-it requirement is imposed for permit renewal (see below);
- the Council will review the limited entry program after 5 years;
- the Council will develop criteria to allow new entry into the limited access fishery in the future.

Use-it or Lose it Requirement for Permit Renewal (Calendar Yr 2000)

Mau Zone limited entry permits expire on December 31 each year. NMFS will renew a permit for the following year if the permit holder's vessel made a minimum of 5 separate landings, each of which consisted of at least 500 pounds of bottomfish management unit species, from the Mau Zone during the previous permit year. Failure to meet the required landing requirement may result in the permit being lost (not renewed). All 1999 Mau Zone limited entry permit holders will be required to meet this permit renewal requirement.

Northwestern Hawaiian Islands (NWHI) Bottomfish Fisheries

During calendar year 1999, The Pacific Islands Area Office (PIAO) in Honolulu, issued a total of 14 permits for the NWHI bottomfish fishery. Seven vessels were registered for the Ho'omalu Zone fishery; 10 vessels were registered with Mau Zone permits. During 1999, seven vessels fished in the Mau zone and six vessels fished in the Ho'omalu zone.

Ho'omalu Zone vessels:

1. Fortuna (sold, no replacement vessel)
2. Fortuna (under new ownership)
3. KaImi Kai
4. Kealailani
5. Laysan
6. Island Girl
7. Windwalker

Mau Zone vessels:

1. Aikane 49
2. Dasher II
3. Honua-Oe
4. Imua
5. Iwa Lani
6. Jamie Elizabeth
7. Kai Pali
8. Leo Marie
9. Wahine Kapaloa I
10. Pursuit

Appendix 6. USCG and NMFS Enforcement Activities

The following report is a combined effort of the U.S. Coast Guard 14th District and the NMFS Southwest Region Office of Enforcement. The report covers the period from 1 January 1999 through 31 December 1999.

During 1999, no Coast Guard enforcement effort was focused solely on the Northwestern Hawaiian Islands (NWHI) bottomfish fishery. Boardings of opportunity on bottomfishing vessels are rare due to the remote fishing areas and scarce participants. Three NWHI bottomfishing vessels were boarded and all were found to be in compliance with the Bottomfish FMP.

The USCG conducted roughly 800 hours of fisheries patrols with C-130 aircraft in the Central and Western Pacific ocean during fiscal year 1999. The C-130 surveillance of the eight non-contiguous EEZs was broken down as follows: 140 hours in the Main Hawaiian Islands, 90 hours in the Northwest Hawaiian islands, 420 hours in Guam and the Northern Mariana Islands, 25 hours in American Samoa, 20 hours in Palmyra Atoll/Kingman Reef, 40 hours in Jarvis Island, and 30 hours in Howland/Baker Islands.

The Coast Guard began a cooperative enforcement program with State of Hawaii Department of Conservation And Resource Enforcement (DOCARE). Assistance to DOCARE will be provided: 1) in the course of normal Coast Guard operations, 2) in response to specific requests for support from DOCARE, and 3) during scheduled cooperative patrols with DOCARE officers.

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Appendix 8. GLOSSARY

TERM	DEFINITION
Alia	Samoan fishing catamaran, about 30 feet long, constructed of aluminum or wood with fiberglass. Used for various fisheries including trolling, longline, and bottomfishing
AP	Advisory Panel. Appointed industry/government/educational representatives functioning in an advisory capacity to the Council.
Armorhead	Groundfish found on the SE Hancock Seamount in the Northwestern Hawaiian Islands
AS or American Samoa	Includes the islands of Tutuila, Manua, Rose and Swains Atolls.
ASDPW	Department of Public Works, American Samoa. Also, DPW.
BARB	Bottomfish Advisory Review Board
BMUS	Bottomfish Management Unit Species, include deep and shallow water bottomfish species
BPT or PT	Bottomfish Plan Team. Advisory body to the Council composed of scientists and fishermen who monitor and manage the fisheries under the jurisdiction of the Bottomfish and Seamount Groundfish FMP.
Bycatch	Fish caught in a fishery but discarded or released, except in a recreational fisheries catch and release program.
Commercial	Commercial fishing, where the catch is intended to be sold, bartered, or traded.
CNMI or the Commonwealth of the Northern Mariana Islands	Also, Northern Mariana Islands, Northern Marianas, and NMI. Includes the islands of Saipan, Tinian, Rota, and many others in the Marianas Archipelago.
CPUE	Catch-Per-Unit-Effort. A standard fisheries index usually expressed as numbers of fish caught per unit of gear per unit of time, eg., number of fish per hook per line-hour or number of fish per 1,000 hooks. The term catch rate is sometimes used when data are insufficiently detailed to calculate an accurate CPUE.
DAWR	Division of Aquatic & Wildlife Resources, Territory of Guam.
DBEDT	Department of Business, Economic Development & Tourism, State of Hawaii.
DFW	Division of Fish & Wildlife, Northern Mariana Islands.
DLNR	Department of Land & Natural Resources, State of Hawaii.

DMWR	Department of Marine & Wildlife Resources, American Samoa. Also, MWR.
EEZ	Exclusive Economic Zone, refers to the sovereign waters of a nation, recognized internationally under the United Nations Convention on the Law of the Sea as extending out 200 nautical miles from shore. Within the U.S., the EEZ typically is between three and 200 nautical miles from shore.
ESA	Endangered Species Act. An Act of Congress passed in 1966 that establishes a federal program to protect species of animals whose survival is threatened by habitat destruction, overutilization, disease etc.
FAD	Fish Aggregating Device; a raft or pontoon, usually tethered, and under which, pelagic fish will concentrate.
FDCC	Fishery Data Coordinating Committee, WPRFMC.
FFA	Forum Fisheries Agency. An agency of the South Pacific Forum, which comprises the independent island states of the South Pacific, Australia and New Zealand. The FFA formed to negotiated access agreements between FFA member countries and distant water fishing nations such as Japan and the USA.
FMP	Fishery Management Plan.
GU or Guam	A U.S. territory in the Marianas Archipelago. South of and adjacent to the Commonwealth of Northern Marianas Islands.
HI or Hawaii	U.S. state. See MHI, NWHI. Composed of the islands, atolls and reefs of the Hawaiian Archipelago from Hawai'i to Kure Atoll, except Midway Islands. Capitol - Honolulu.
HDAR	Hawaii Division of Aquatic Resources. Also, DAR.
HIMB	Hawaii Institute of Marine Biology, University of Hawaii.
Hoomalu Zone	Limited entry bottomfish management area located in the northwestern Hawaiian Islands, includes area from French Frigate Shoals to Kure atoll, including Hancock seamount.
Incidental Catch	Fish caught that are retained in whole or part, though not necessarily the targeted species. Examples include monchong, opah and sharks.
Interaction	Catch of protected species, which is required to be released. Examples: Hawaiian monk seals, marine turtles and albatrosses.
Logbook	Journal kept by fishing vessels for each fishing trip; records catch data, including bycatch and incidental catch. Logbooks reported to HDAR.
Mau Zone	Limited entry bottomfish management area located north of Kauai to Necker Island at 165° W.

MFCMA	Magnuson Fishery Conservation and Management Act of 1976. Also, Magnuson-Stevens Fishery Conservation and Management Act of 1996. Sustainable Fisheries Act.
MHI	Main Hawaiian Islands (comprising the islands of Hawai'i, Mau'i, Lana'i, Moloka'i, Kaho'olawe, O'ahu, Kauai', Ni'ihau and Ka'ula).
MSY	Maximum Sustainable Yield.
NMFS	National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Department of Commerce. Also NOAA Fisheries.
NOAA	National Oceanic and Atmospheric Administration, Department of Commerce.
NWHI	Northwestern Hawaiian Islands. All islands in the Hawaiian Archipelago, other than the Main Hawaiian Islands (MHI).
OY	Optimum Yield.
PIAO	Pacific Islands Area Office, National Marine Fisheries Service. Also, NMFS/PIAO.
Protected	Refers to species which are protected by federal legislation such as the Endangered Species Act, Marine Mammal Protection Act, and Migratory Bird Treaty Act. Examples: Black-footed and Laysan albatrosses, marine turtles, dolphins.
Recreational	Recreational fishing for sport or pleasure, where the catch is not sold, bartered or traded.
SAFE	Stock Assessment and Fishery Evaluation, NMFS.
Sanctuary	Protected area. Commercial/recreational fishing may be restricted.
Secretary	When capitalized and used in reference to fisheries within the U.S. EEZs, it refers to the U. S. Secretary of Commerce.
SPC	Secretariet of the Pacific Community. A technical assistance organization comprising the independent island states of the tropical Pacific Ocean, dependant territories and the metropolitan countries of Australia, New Zealand, USA, France and Britain.
SPR	Spawning Potential Ratio. A term for a method to measure the effects of fishing pressure on a stock by expressing the spawning potential of the fished biomass as a percentage of the unfished virgin spawning biomass. Stocks are deemed to be overfished when the SPR<20%.
SSC	Scientific & Statistical Committee, an advisory body to the Council comprising experts in fisheries, marine biology, oceanography, etc.
Trolling	Fishing by towing lines with lures or live-bait from a moving vessel.

USCG U.S. Coast Guard, 14th District, Department of Transportation.

USFWS U.S. Fish & Wildlife Service, Department of Interior. Also, FWS.

VMS Vessel Monitoring System. A satellite based system for locating and tracking fishing vessels. Fishing vessels carry a transponder which can be located by overhead satellites. Two-way communication is also possible via most VMS systems.

WPacFIN Western Pacific Fishery Information Network, NMFS.

WPRFMC Also, the Council. Western Pacific Regional Fishery Management Council. One of eight nationwide fishery management bodies created by the Magnuson Fisheries Conservation and Management Act pf 1976 to develop and manage domestic fisheries in the U.S. EEZ. Composed of American Samoa, Guam, Hawaii, and Commonwealth of Northern Mariana Islands.